Montana Outdoors

May–June 2006

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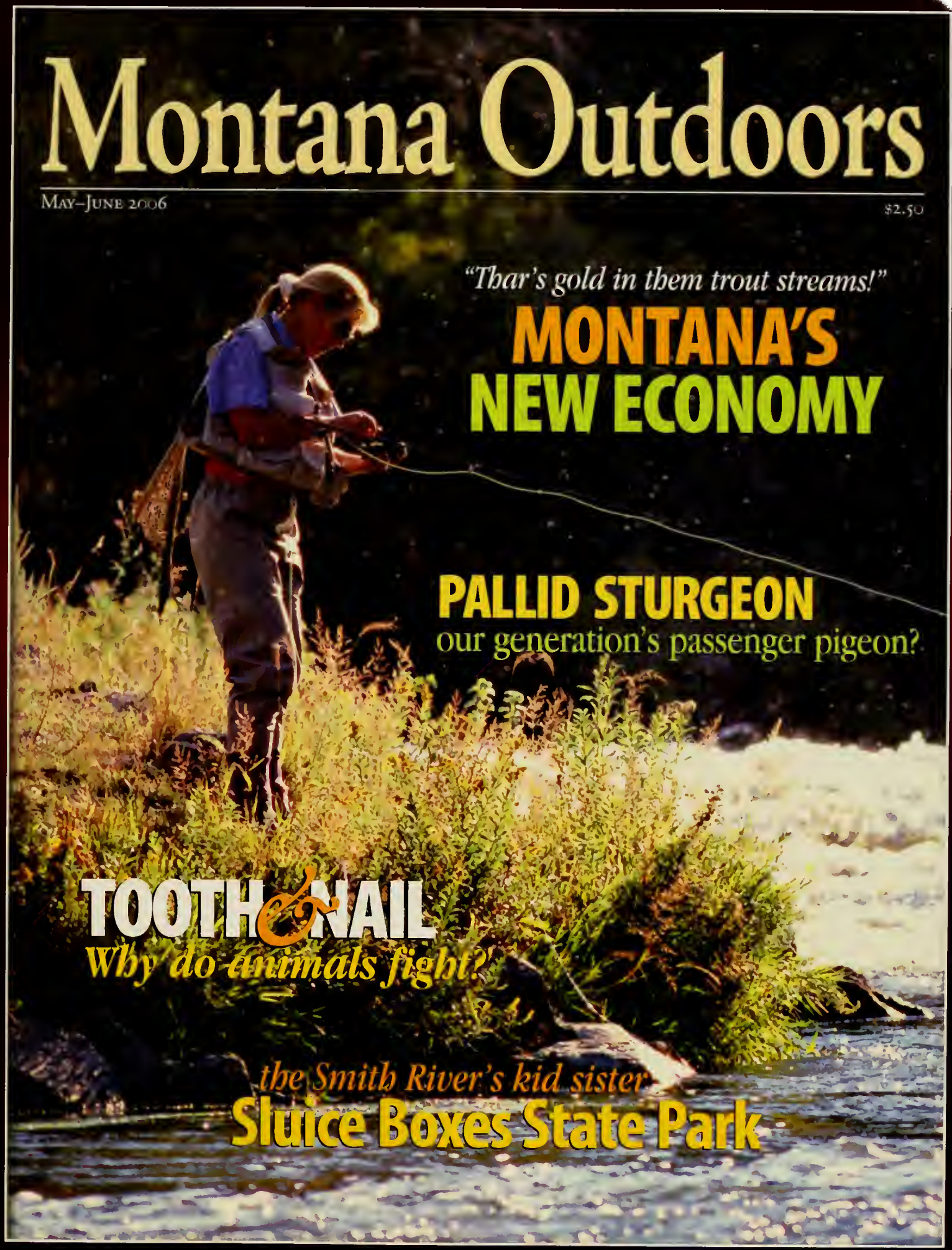


"Thar's gold in them trout streams!"

MONTANA'S NEW ECONOMY

PALLID STURGEON

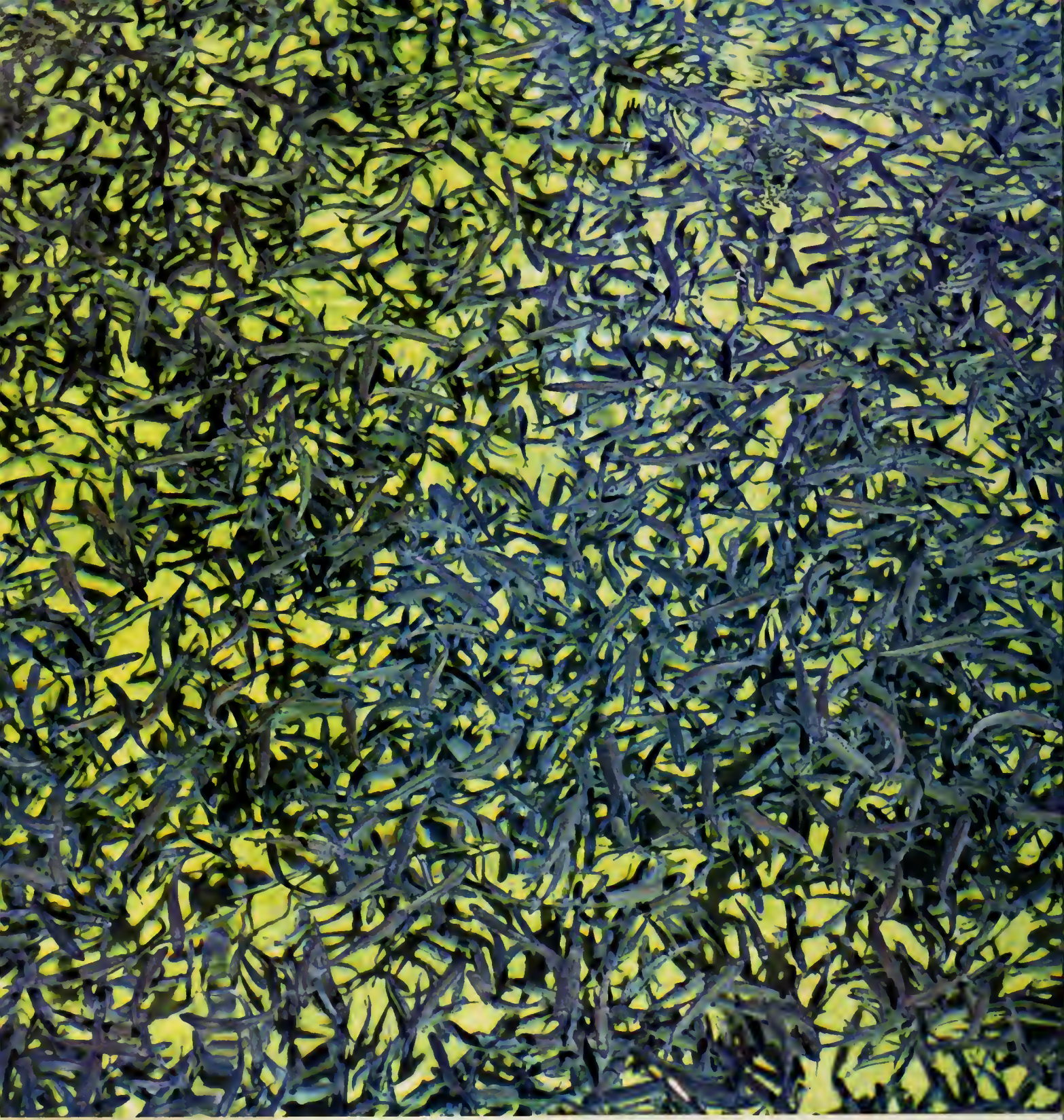
our generation's passenger pigeon?

TOOTH & NAIL

Why do animals fight?

the Smith River's kid sister

Sluice Boxes State Park



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Montana Outdoors

MAY–JUNE 2006

FEATURES

6 Taking Aim at Depredation Montana's new liberalized elk and deer season is designed to help landowners and hunters. *By Tom Dickson*

8 Saving the Golden Goose Will Montana conserve the natural resources fueling its economic growth? *By Tom Dickson*

14 A Grand Little Canyon Excellent trout fishing, rich mining history, and breathtaking scenery make Sluice Boxes one of the most delightful state parks you've never heard of. *By Jeff Erickson*

JEREMIE HOLLMAN

8 THE MONTANA CHALLENGE

20 A Whisker Away from Winking Out Will the pallid sturgeon go extinct on our watch? *By Andrew McKean*

26 Hatchery Pride Essential for warmwater fisheries, mountain lake fishing, and protecting some endangered species, FWP's fish-rearing facilities have plenty to boast about. *By Dave Hagengruber*

32 Wildlife Warriors "Peaceable kingdom"? Not in the real, often violent world of nature. *By Sam Curtis*

DEPARTMENTS

2 LETTERS

3 OUR POINT OF VIEW A New Place to Learn

3 NATURAL WONDERS

4 OUTDOORS REPORT

13 OUT HERE Getting to the Root of the Problem

37 OUTDOORS PORTRAIT Walleye

38 PARTING SHOT Living Fossil

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TROUT FARM Thousands of rainbow trout fingerlings swarm in the Big Springs Hatchery in Lewistown. See page 26 to learn where these fish are headed. Photo by Neal & MJ Mishler.

ON THE COVER Are fly fishing and other outdoor activities Montana's new gold mines? See page 8. Photo by denverbryan.com.

LETTERS

We will

This note is to let you know how much I appreciate *Montana Outdoors* magazine. The March–April issue is another amazing example of your fine work. Your magazine is well balanced in its approach to controversial issues, the photography is absolutely superb, and the quality of the material makes the magazine a pleasure to read, observe, and display on the coffee table so all guests can enjoy it also. Thank you for your hard work and please continue.

L. Sanford Selvey, II
Billings

CHUCK HANEY

What the...?

On page 4 of your January–February issue is a photograph of three antelope does. Two appear to have something orange or red projecting from their ears. I have hunted antelope in Texas and Wyoming and have watched them while driving in Colorado and Montana. But I have never seen anything like those brightly colored projections. What are they?

Sam Turneabe
Garland, Texas

Those strange-looking objects are ear tags, which wildlife biologists use to identify pronghorn they are studying.

Harmful or not?

Your antler hunting article ("Shedding Light on Antler Collecting," March–April) sends a mixed message. On one hand you say it is harmless family fun, and on the other you say it could be harmful to deer and elk. Which is it?

L. Robert Furtman
Seattle, Washington

I read with interest the story on antler collecting. To your knowledge, has there ever been a study made of the ecological effects of the constant removal of antlers or skulls from wildland ecosystems? Certainly the soil fertility of the Great Plains has been reduced over the last 150 years. This has to be, in some undermined measure, caused by the constant removal of biomass (the flesh, bones, hides of millions of bison followed by the complete removal of subsequent livestock that followed).The bones are rich in such minerals as calcium, phosphorous, and other nutrients. They are certainly being removed faster than the natural biogeochemical weathering processes can replace them. Left on the land, these nutrients would be recycled back into the ecosystem while maintaining soil fertility. How many stacks of antlers or "horn houses" do we need to satisfy our egos?

Chuck Neal
Cody, Wyoming

Regarding the relative harm of antler collecting, it depends mainly on the time of year. If done too early, say some biologists, antler collecting could stress wild ungulates. But when done after May 15, the opening date on most major wildlife management areas, deer and elk have moved far enough back up into the timber to avoid people.

As far as we know, there has been no study on the ecological effects of antler removal. Lacking scientific data, biologists have mixed opinions on the issue. Some maintain that any loss of minerals from a natural landscape is a bad thing. They say shed antlers don't go to waste but are often chewed up by rodents, providing the animals with necessary minerals and opportunities to keep their teeth worn down.

Other biologists, however, say the ecological "loss" of antler minerals due to collecting is insignificant. Collected antlers eventually, over geologic time, return back to the soil. And even in the short term, the vast majority of antlers shed each year remain where they fell and get recycled locally.

There are many other factors to consider when discussing Great Plains soil fertility, such as the depletion of soil minerals from erosion. The importation of bananas, coffee, and other foods and goods that end up in local landfills or sewage systems may be considered as adding nutrients and minerals to local landscapes. And some scientists maintain that the eruption of Mount St. Helens and the eastward drift of dust from the explosion may have added more minerals to the Montana plains than have ever been removed.

Lucky gophers

The burrowing owl on the cover of the March–April 2006 issue brought back memories. Back in 1932 we were trapping gophers in Pondera County, and I wouldn't set any more traps after catching one of the little fellows. The owl looked so sad hung up in a trap. Many gophers lived longer lives on account of this. By the way, Parker Homestead State Park is not near Belgrade as you stated. It's near Three Forks.

Ervin McMillin
Twin Bridges

Inverted image

I enjoyed your March–April issue very much. However, unless photographer Phil Farnes was standing on his head when he took the photo, it appears that the image of pictographs on page 29 is upside down.

John L. Stoner
Townsend

Photographer Phil Farnes had both feet planted firmly on the ground when he took that photograph at Pictograph Cave State Park. The reversal was our error.

TOM DICKSON

"How many times have I told you not to play with your food?"

A New Place to Learn

Where in Montana can you learn how a trout stream works, why wolves howl, what fish and wildlife managers do, and where to find horned toads? Right now, FWP has no place where groups of visitors can learn about these and other aspects of Montana's natural world and conservation history. But we plan to have one soon.

A top priority for this department over the next few years is to create what we're calling the Wildlife Education Center. The new facility will be the second half of the Montana Wildlife Center Complex, which includes the Wildlife Rehabilitation Center. (The rehabilitation center, built in 2003 to replace a rundown facility across town, temporarily houses orphaned wildlife—primarily bear cubs—until they can be released back into the wild.)

The education center will be in the historic Stedman Foundry building, located near Spring Meadow Lake State Park on Helena's west side. We plan to outfit the center with state-of-the-art technology and interpretive displays, making it the premier conservation education facility in Montana.

Some exhibits will show wildlife in their natural habitats. One will tell the story of how Montanans have worked together over the past century to restore wildlife populations. A classroom learning center will be used by school groups, hunter and angler education students, and members of conservation education organizations. Students will have access to our department's vast collection of wildlife pelts, skulls, and mounts, as wells as eggs, birds nests, snake skins, and other interesting items.

We're especially excited about the center's theater and multipurpose room, which will seat 100 people. Visitors will be able to watch movies and videos and listen to outdoors education experts. The theater—including a kitchen, tables, and AV equipment—will be available for lectures, satellite links, teacher workshops, community meetings, and more.

Running inside and outside the center will be a real coldwater stream, where visitors will see trout, whitefish, and sculpins in their natural setting. I can't think of a better way for people to learn how aquatic ecosystems work than to actually look down and see fish feeding on underwater insects. A backyard pond will hold largemouth bass, sunfish, and other warmwater species. Also outside will be an amphitheater where visitors can enjoy day and evening performances while looking out at the scenic state park and distant mountains.

Sales of books, CDs, DVDs, posters, and other items in a gift shop at the education center will help fund the center's operations.

So far we have stabilized the 7,000-square-foot Stedman Foundry building, originally built in the 1890s, and fitted it with electricity and plumbing. The FWP Foundation is raising funds to complete construction. The total cost of the facility will be $3 million.

Every year more than 13,000 school kids from across Montana come to Helena to visit the state capitol. Roughly 80,000 people visit Spring Meadow Lake State Park annually. The new Wildlife Education Center will attract residents, students, tourists, and conservation groups interested in nature study, fish and wildlife conservation, and Montana history.

The center will be more than just a fun place to visit. FWP's mission is to provide for the stewardship of Montana's fish and wildlife. We can only do that with the support and cooperation of the state's citizens. We want the new education center to instill in visitors an appreciation for Montana's diverse land and water environments, and an understanding of how fish and wildlife are managed. That way, we hope, even more people will become partners with FWP and work cooperatively with us to conserve the fish, wildlife, and habitat so important to Montana's history and its future.

—M. Jeff Hagener, *Director, Montana Fish, Wildlife & Parks*

To learn how you, your family, or your organization can help contribute to the Montana Wildlife Center Complex, call the FWP Foundation at (406) 444-6759 or visit FWPFoundation@mt.gov.

NATURAL WONDERS

Illustrations by Pearl Grosshuesch

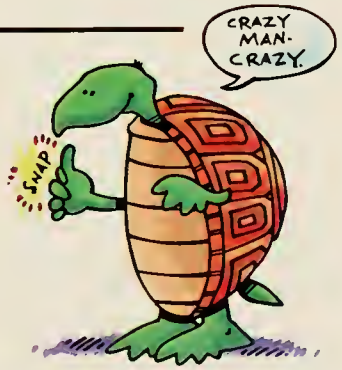
Q. ***How do you tell the sex of a fish?***

A. It's difficult, even for biologists. Males of some species, such as sunfish, are more colorful during the spring spawning season. Male trout and salmon grow hooked lower jaws, called *kypes*. But with most fish, the only way to tell is to see if its belly is round with eggs during the spawning season. If so, it's a female.

Q. ***How much of my state taxes goes to Montana Fish, Wildlife & Parks?***

A. None. Most FWP revenue comes from hunting and fishing licenses (65%), federal programs such as the excise taxes on ammunition, firearms, and fishing and boating equipment (25%), and other state funds such as the $4 surcharge on vehicle registration for state parks.

Q. ***I grew up in Iowa, where snapping turtles were common. Are any of these big reptiles in Montana?***



A. There are, but only in the state's southeastern region. These massive turtles, which can weigh up to 48 pounds in Montana, are found in the Tongue, Yellowstone, and other larger rivers, as well as in lakes and ponds. They eat crayfish, fish, plants, and the occasional finger.

Whew! Bison hunt goes smoothly

TOM BAUER

Helena resident Jeff Vader searching for bison near Gardiner. His midwinter hunt was featured in the *New York Times* and the *Los Angeles Times*.

When Jeff Vader of Helena placed his scope's crosshairs on the ear of a bull bison, he felt like the whole nation was watching. And in some ways, it was. A photographer for the *New York Times* and a reporter for the *Los Angeles Times* were accompanying him on the January 16 hunt near the northwest entrance of Yellowstone National Park.

"I was definitely nervous," says Vader, one of several dozen hunters who took part in Montana's first bison hunt in 15 years. "Try hunting with an audience like that."

Both journalists were there with the hunter's permission. "They'd asked other hunters and weren't getting much response, so I said sure," Vader says. "I was real confident we would conduct a safe and ethical hunt and there would be no problem."

Problems were the last thing FWP officials wanted. When Montana previously conducted a bison hunt, national TV news showed protesters clashing with hunters, game wardens leading hunters up to shoot bison at point-blank range, and dying bison writhing on the ground. This time around, the agency worked closely with hunters and hunting groups to ensure the bison were pursued under conditions of fair chase. Hunters received no assistance in the field from FWP staff. They had to find bison on their own in an expanded hunting area covering 60,000 acres. And all hunters were required to take an orientation session held by FWP.

More than 6,000 hunters, mostly Montanans, applied for a chance to hunt the bison, which are spilling out of Yellowstone National Park in search of grass. Since hunting seasons were stopped in the early 1990s, the Yellowstone herd had burgeoned to nearly 5,000 animals. Nearby ranchers say the bison could infect their cattle with brucellosis, which can cause cows to abort. Montana could lose its brucellosis-free status, costing the state's ranching industry millions of dollars.

> "The first thing I did was borrow my brother's cell phone and call our mom."

TOM BAUER

The Montana legislature approved restoring a hunting season, and the FWP Commission approved a total harvest of 50 animals in the first season. Thirty-four licenses were awarded by lottery and 16 were provided to Indian tribes.

The hunting took place near the park's northwest entrance around Gardiner and near the west entrance by West Yellowstone. Hunters killed 39 bulls and one cow bison during the three-month season.

A group opposing the hunts, which it called "illegitimate" and "unfair," filmed the kills and petitioned the state to stop the hunts. However, the Buffalo Field Campaign did not interfere with the actual hunts. Group cofounder Mike Mease, himself a subsistence hunter, was quoted in the *New York Times* as saying he could even support a different type of hunt in the future. "We're not an anti-hunting group," he told a reporter.

According to Mel Frost, FWP information officer in Bozeman, the department is working toward managing bison as it does other big game animals.

"Holding a hunting season is an important first step toward doing that," she says.

Though Wyoming, South Dakota, and several other states hold public bison hunts, FWP officials were concerned that intense public interest in the Montana hunt would create a black eye for the agency and hunters. However protests were mild, media coverage was fair, and the hunts went smoothly.

"The hunters did an outstanding job," says Frost. "They were all well prepared, they represented Montana admirably, and they took their responsibility seriously."

Vader certainly did. He says his heart was pounding when he finally had the chance to shoot a bison. His biggest concern was wounding one, so he had spent hours practicing his marksmanship to ensure a quick and clean kill. After stalking several herds with his brother, who had come along to help, Vader finally crept up to within 80 yards of a group. With the journalists watching, he took aim and, letting out a slow breath, squeezed the trigger. "That bull dropped dead like a ton of bricks," Vader says. "The first thing I did was borrow my brother's cell phone and call our mom."

FWP hires new state parks chief

Joe Maurier, a 25-year veteran of the Colorado Division of Parks, has been named the new Parks Division administrator for Montana Fish, Wildlife & Parks in Helena. Maurier replaces Doug Monger, who retired from FWP last year.

At the Colorado Division of Parks, Maurier held positions ranging from park ranger to deputy director. "Joe's experience in Colorado, which has a park system facing demands from a rapidly growing population, will be a great asset to Montana," says Jeff Hagener, FWP director.

Maurier, an avid hunter and angler, received a degree in outdoor recreation from Colorado State University in 1978. While in college, he worked on a Montana ranch.

MONTANA FWP

Maurier: an old ranch hand.

"I really have some great memories of my time in Montana," Maurier says. "And now I'm excited about being back and having this opportunity to work with Montana's great state parks system."

Anglers scramble to break pygmy whitefish state record

Pygmy whitefish state records toppled like dominoes in early 2005, as four new records were set within the space of one month. All four were caught by Kalispell residents in Little Bitterroot Lake, 20 miles west of Kalispell. These were the only state fish records broken in 2005.

A small relative of trout, the pygmy whitefish is found in deep, cold lakes of northwestern Montana. The native salmonid is usually caught by ice anglers fishing for kokanee salmon.

The previous record of 0.18 pounds, caught in 1999 in Ashley Lake, was broken on January 28, 2005, by Brent Mitchell with a 0.20-pound whopper. Mitchell had only a short time to savor his achievement, however, because Alvin Ammann hauled in a 0.21-pounder on February 14.

Nine days later, that record tumbled when Kevin Hadley bested Ammann's mark with a pygmy whitefish of 0.23 pounds (about what a bratwurst weighs). On the same day, another 0.23-pounder was caught by nine-year-old Troy Fraley.

"Both fish are now certified as the Montana state record for pygmy whitefish," says Jim Vashro, FWP's northwestern region fisheries manager, "though Troy really does retain bragging rights, because his 9-inch fish was ¼ inch longer than Hadley's."

Vashro and other biologists are now waiting for an angler to catch the next great pygmy whitefish. Some even speculate that a monster "quarter-pounder" could lurk in the depths of Little Bitterroot Lake.

MONTANA FWP

Troy Fraley with his co-state record pygmy whitefish, which tipped the scales at 0.23 pounds.

TROY HELMICK

The black snakes of Townsend

Visitors following the Lewis and Clark Trail can still see many animals observed by the intrepid explorers 200 years ago—pronghorn, mule deer, coyote, Clark's nutcracker, and an odd little black snake found almost nowhere else in North America.

Though some scientists are still studying the reptile, the all-black snake is most likely a melanistic (black pigmentation) form of either the common or other subspecies of garter snake. Black phases of animals have higher amounts of black skin pigmentation than other pigmentation. Tigers, leopards, squirrels, and some reptiles are the most common animals that occasionally appear in a melanistic phase.

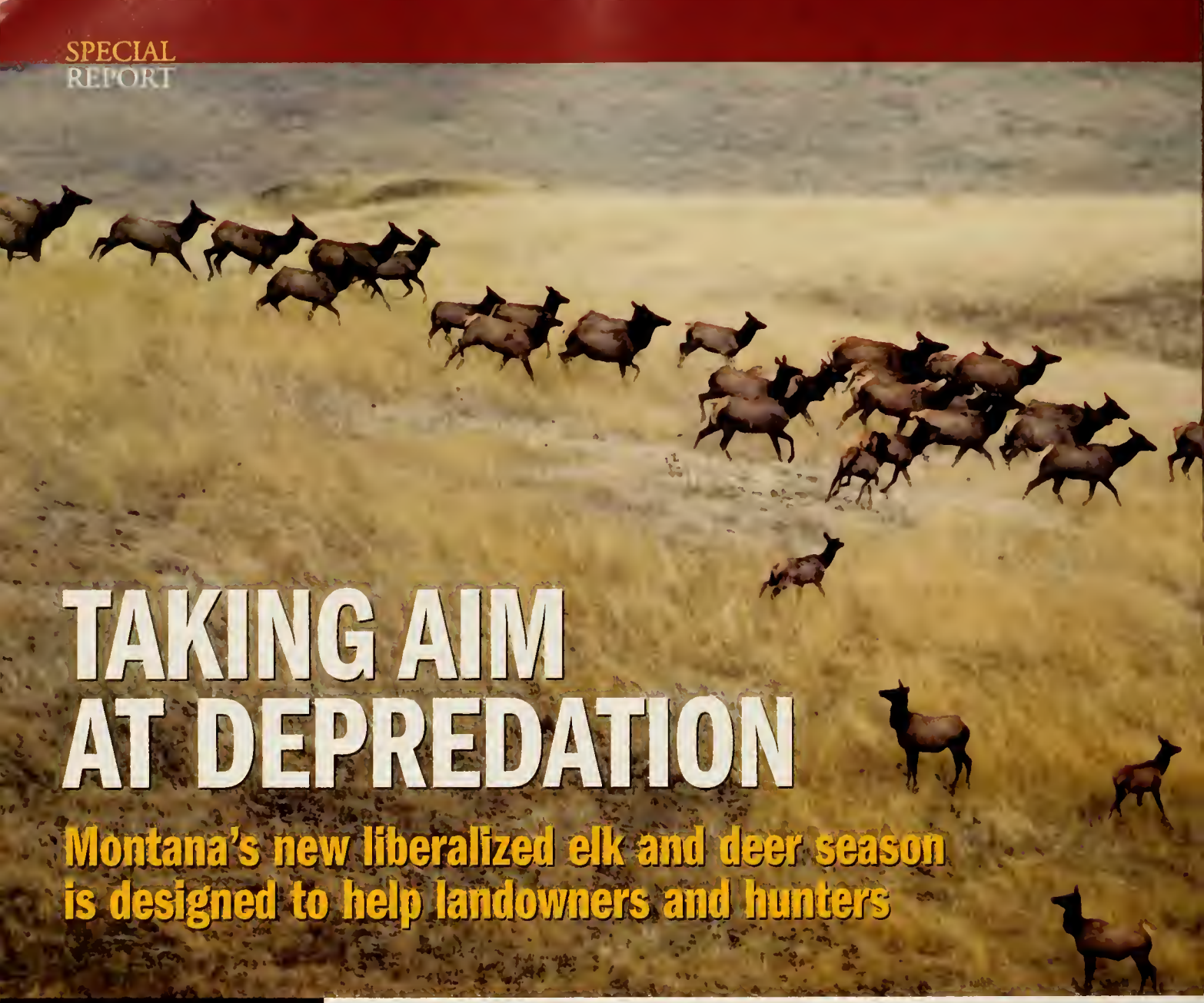
On July 23, 1805, the Corps of Discovery camped along an island roughly 2 miles north of today's Townsend. "I saw a black snake today about two feet long the belly of which was as black as any other part or as jet itself," wrote Captain Meriwether Lewis. The next day, expedition members saw several other black snakes around what is now called York's Island

Over the past several years, members of the Crimson Bluffs Chapter of the Lewis and Clark Trail Heritage Foundation have been promoting the black snakes as a way to commemorate the expedition's bicentennial. Chapter member Troy Helmick says more than 50 sightings of black snakes in the Townsend area have been confirmed, along with reports as far north along the Missouri River as Great Falls.

Five black snakes have been collected and sent to Dr. Grant Hokit, a biology professor at Carroll College in Helena, for further study.

Why is Townsend a black snake hotspot? No one knows for sure. Black garter snakes have also been reported from an island off the coast of Nova Scotia, around Lake Erie, and in a few other sites in North America.

"Melanism in a population like these garter snakes is likely due to inbreeding in an isolated population," says Walt Timmerman, a herpetologist who works for the FWP Parks Division. "What's particularly interesting about these snakes is that they are the only population I know of that is entirely jet black, with out a trace of lighter color anywhere. That's unique." ■



TAKING AIM AT DEPREDATION

Montana's new liberalized elk and deer season is designed to help landowners and hunters

BY TOM DICKSON

FWP officials are hoping a new liberalized five-week season that begins this fall in areas with overabundant elk will provide more opportunities for hunters while reducing elk numbers and associated depredation problems for landowners.

"Many landowners are having some real difficulties," says Gary Hammond, supervisor of FWP's south-central region. "In some areas, there are too many elk feeding on haystacks in winter, early-season grasses in spring, and standing crops in summer and fall." Hammond adds that overabundant elk on a few winter ranges are damaging grassland and woody shrub habitat.

Though Montana's elk harvest has nearly tripled since the mid-1970s, it hasn't been enough to reduce elk populations in many hunting districts. FWP has substantially increased the number of antlerless permits and special late and early seasons. But that hasn't been sufficient to keep elk numbers from growing in many areas.

Adding to the problem: Reduced access on public and private land for public hunting has made it harder for hunters to harvest elk.

Currently, 50 percent of Montana's elk management units exceed their target elk populations; more than 70 percent of units with special seasons have too many elk.

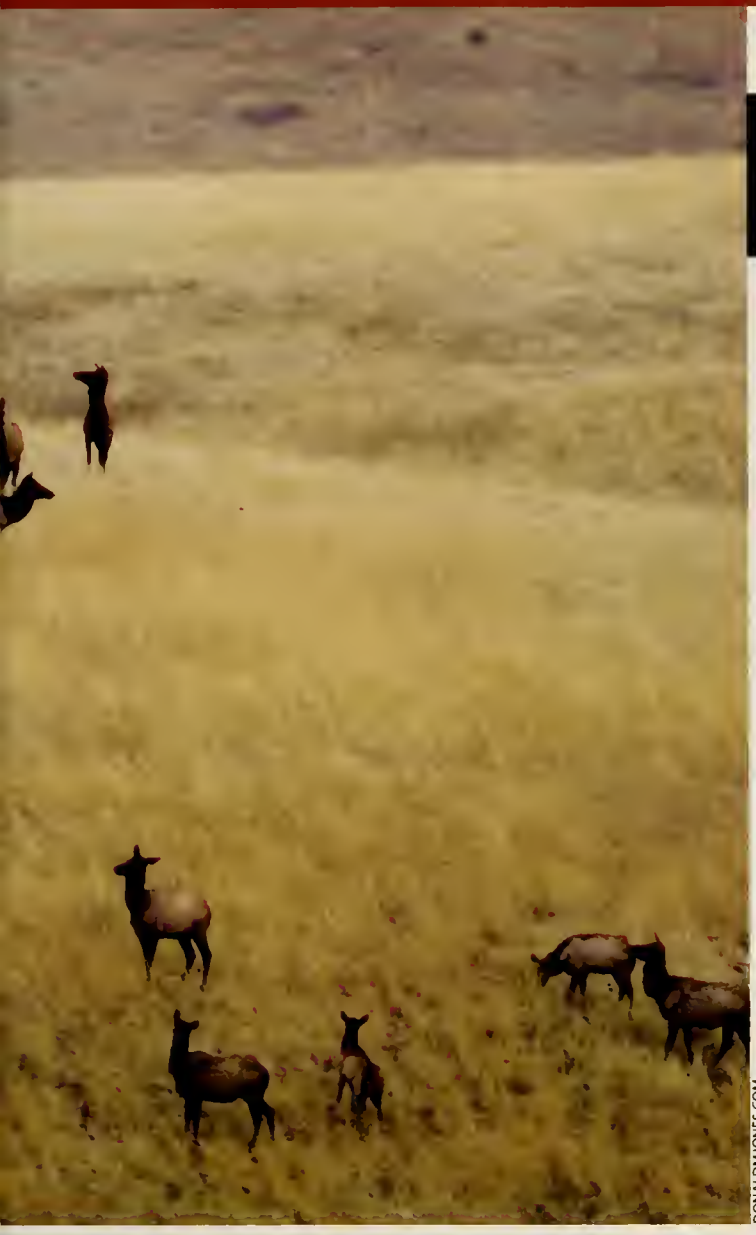
Over the past three decades, FWP has been relatively conservative in its use of either-sex seasons to manage elk. "But now we are obligated to try something different," Hammond says.

In February, the FWP Commission eliminated most special seasons and reaffirmed its commitment to using the five-week season as the main tool for managing elk populations.

Montana's recently revised elk management plan, which guides elk management decisions, set population objectives for areas throughout Montana. The objectives factor in landowner tolerance, hunter requests, and biological data. The plan notes that existing seasons, including late and early special hunts, have failed to lower elk numbers to population objectives.

"We've had so many special seasons that elk could move around and escape hunters," Hammond explains. "When one season opened, another right next door closed, and the elk moved

Tom Dickson is editor of Montana Outdoors.



DONALD MONES.COM

TOO MUCH OF A GOOD THING Frustrated that elk numbers continue to climb in many areas, the FWP Commission decided to eliminate most special early and late seasons and increase antlerless elk hunting opportunities during the five-week season.

from one area to another."

Hammond adds that elk also congregate on private land that is off-limits to public hunting.

"By eliminating most special seasons, which hunters told us were way too complex, we can apply more uniform pressure during the five-week season," he says. "That will distribute elk more widely and allow hunters to reach them more effectively."

Though the liberalized season is designed to increase cow harvest, another benefit may be to provide hunters with more access to bulls. Many hunters complain that too many landowners allow access during the regular season only to those willing to pay for bulls. Local hunters are allowed in only during late seasons to remove cow elk for population control.

This often doesn't work because the elk move to districts without late-season hunts. Also, it bothers many hunters that they never have access to bulls.

"One of the chief complaints from hunters as we revised our elk management plan was the equity issue," says Hammond. "Hunters believe it's unfair they don't have more opportunities to hunt bull elk."

Though the five-week season remains the core of FWP's new elk and deer management system, there still may be some late-season hunting. Hammond says the FWP Commission has the authority to extend the general five-week season in certain hunting districts when harvests are too low. Also, FWP will offer early-season backcountry hunts, as well as some late-season hunts aimed at reducing migratory elk populations.

In addition, FWP officials say they are prepared to use game damage assistance—which could include special game damage hunts—to address specific problems of elk and deer causing damage. Damage hunts would be targeted at specific spots where elk and deer are actually causing problems. FWP is developing rules it will adopt in late summer that define and address game damage. When damage hunts are required in certain areas, FWP plans to draw names from rosters of hunters who apply for specific hunting districts.

"We're committed to having a more proactive and streamlined system of addressing game damage problems," Hammond says.

Over the past several months, Hammond and other FWP staff have presented the new season format to landowner, stockgrower, and hunting groups.

"One thing we've said is that this proposal doesn't prevent landowners from fee hunting," Hammond says. "But it's no longer the case that someone can sell bull hunting privileges, not allow public access, and then expect FWP to provide a late-season damage hunt to knock down cow elk numbers."

Hammond says the new format provides landowners with the public hunting "management tools" they need to manage elk at the levels they want to see on their property. "Landowners with too many elk can invite the public in during the five-week season to help reduce numbers," he explains. "By the same token, landowners satisfied with elk numbers on their property still have the option of restricting public access however they wish."

"We're committed to having a more proactive and streamlined system of addressing game damage problems."

Hammond notes that hunters also will have to make some adjustments to the new season structure. Hunters accustomed to easier late-season conditions—when snow pushes elk down from the mountains into open areas near roads—may have to work harder during the five-week season to get their elk.

"But the point of this change is to make more elk available to hunters," says Hammond. "So we're anticipating that most hunters will benefit."

SAVING THE GOLI

Another large home goes up in the fast-growing Bitterroot Valley. Scenery-inspired population growth is fueling many Montana economies, such as in Ravalli County. But some economists and conservation leaders are warning that failure to address environmental problems such as overdevelopment eventually could lead to economic decline.

DEN GOOSE

Will Montana conserve the natural resources fueling its economic growth?

Suresh Daniel could have located his biotechnology company almost anywhere. "I really should be in southern California or on the East Coast," says the president of Rocky Mountain Biologicals, Inc., a new Missoula-based company that manufactures and markets bovine-derived blood products for the pharmaceutical industry. "But I fell in love with the fly fishing here in Montana."

Daniel's business, which he started in 2005, already employs seven people. "We're growing fast," he says. An educated workforce from the nearby University of Montana, where Daniel graduated in 1996, is an added attraction. "But the main reason we're here is the quality of life, particularly the outdoors," he says.

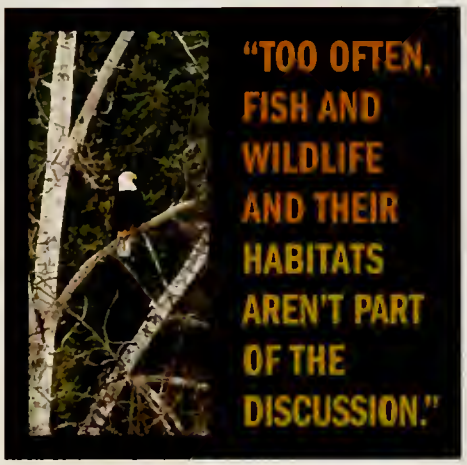
A century ago, prospectors came to Montana and cried, "That's gold in them hills." Today, state and community leaders are seeing Montana's mountains—as well as its abundant trout streams, wildlife populations, and access to public land—as the state's "new gold." Increasingly, people have been moving to Big Sky Country and bringing their businesses and wealth with them. That growth is fueling local economies from Eureka to Billings.

"Montana's wild lands and wildlife have helped 'brand' our state as an extraordinary place to live and do business," says SuzAnne Miller, a statistical analyst specializing in tourism and wildlife issues. Over the past two years, Miller has been crisscrossing Montana speaking to civic groups about the state's rapidly changing demographics and economy. "Much of Montana is benefiting economically as people move here for the mountains and the trout fishing and then start new businesses," she says. >>>

BY TOM DICKSON

In their popular history, *Montana: Tale of Two Centuries*, historians Michael Malone and Richard Roeder write: "Across the nation, and even the world, Montana has become a byword for unspoiled nature and the good life."

The challenge to Montanans, according to Miller and many economists and social scientists, is to manage the state's natural resources in a way that protects the good life—which includes traditional values such as hunting and ranching—"while also continuing to attract people who are building the economy of the future," she says.



NOT FACTORED IN

Professionals in natural resources management have long believed that healthy landscapes, abundant public access, and thriving fish and wildlife populations are essential to Montana's quality of life and economic growth. State and federal studies show that hunters, anglers, and wildlife watchers spend roughly $1 billion in Montana each year and support the equivalent of 8,100 full-time jobs. Other outdoor attractions such as national parks, wilderness areas, grizzly bears, and open ranchland scenery help fuel the state's $2 billion tourism industry.

Unfortunately, says Chris Smith, chief of staff for Montana Fish, Wildlife & Parks, important economic decisions made in Montana often don't include the cultural and economic value of wildlife and wild lands.

"Too often, fish and wildlife and their habitats aren't part of the discussion," he says.

In 2002 FWP and the U.S. Forest Service set out to better understand the relationship between Montana's natural resources and the state's economy. They hired Miller to analyze results by more than a dozen social science researchers, demographers, political scientists, and economists who had been studying socioeconomic trends in Montana and elsewhere in the Rocky Mountain West.

The findings, which Miller compiled as part of a project called the Montana Challenge, paint a different economic picture than what is often depicted in literature and legislative committees. The research shows that Big Sky Country is still home to cattle ranches, wheat farms, mines, and sawmills. But in the past two decades, those historical elements of the state's economy have stagnated. Accounting for most economic growth are flourishing professional and service industries such as health care, real estate, construction, and finance.

Almost all of that growth came in Montana's western counties (see sidebar, below). The reason? "Location, location, location," says Miller. She explains that new residents seek a specific combination of outdoor amenities such as trout streams and scenic hiking trails along with accessible urban facilities such as Internet cafes and state-of-the-art health care facilities.

"That's what you find in Flathead and Gallatin counties," she says. "And that's why people are going there."

A 2005 study by a national public research

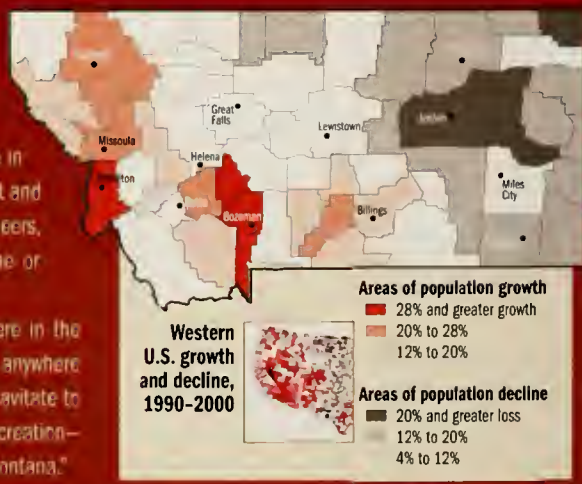
WESTERN MONTANA: Part of the rapidly growing "Third Coast"

The latest U.S. Census shows that both population and economies grew from 1990 to 2000 in the western and central Montana counties surrounding Whitefish, Missoula, Hamilton, Bozeman, and Billings. Growth in these "regional population centers" mirrored trends elsewhere in the Rocky Mountain West, dubbed the "Third Coast" for its steady growth in population and wealth.

Populations and economic prosperity declined or remained flat in almost every eastern Montana county, as was the case in other regions of the Great Plains.

SuzAnne Miller, a statistical analyst who has been studying demographic and economic trends, says most of the newcomers to western Montana are Baby Boomers in their early 40s to early 60s, often financially secure. What Miller finds especially interesting is that many new residents have strong nostalgic feelings for the Rocky Mountain West. They grew up in the 1950s and '60s watching Davy Crockett and Roy Rogers, listening to Sons of the Pioneers, and taking family vacations in Yellowstone or Glacier national parks.

"Today these people can move anywhere in the United States—and with the Internet, work anywhere in the United States," says Miller. "Many gravitate to places they associate with freedom and recreation—and for a growing number, that place is Montana."



SOURCE: CENTER FOR THE ROCKY MOUNTAIN WEST

group found that 95 percent of new residents moved to Montana in large part due to the state's natural beauty. Three of four said outdoor recreation such as wildlife watching, hunting, and fishing are important reasons for living here.

"People are increasingly seeking out high-quality places to live and work," says Larry Swanson, director of the University of Montana's Center for the Rocky Mountain West. "For most growing areas in Montana, a quality natural environment has become their chief economic asset."

Some new arrivals are retirees wanting to pass their golden years staring at snow-capped peaks from an easy chair. But many, says Miller, "are moving here and starting up small businesses or otherwise helping the state's economy."

For example, national magazines such as *Outside* and *Men's Journal* regularly cite Bozeman as being one of America's most livable cities. But recently, American City Business Journals named Bozeman as the top small city in the United States for small business virality.

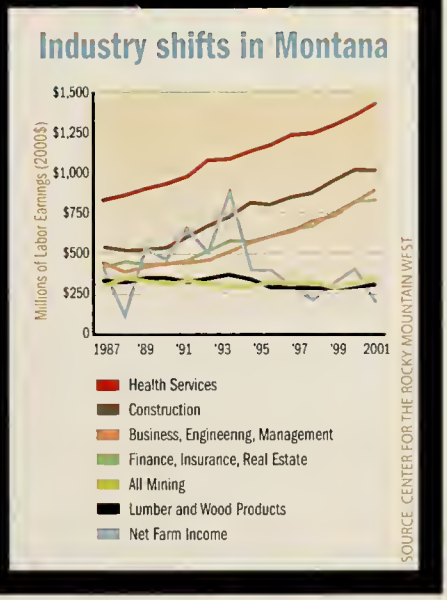
Merlin Information Services founder Michael Dores and his wife moved their database search and retrieval business from California to Kalispell "because we wanted to live in this incredibly beautiful location," he says. Patrick Markey, producer of *The Joy Luck Club* and *The Horse Whisperer* and an avid fly fisherman, fell in love with Montana and moved to Livingston in the mid-1990s. Over the past several years, Markey has been working with other Montana producers, actors, and directors to rejuvenate the state's film industry, which has lost business to Canada.

Other new residents lured by Montana's outdoors bring wealth and a philanthropic bent that can improve the state's quality of life. Software tycoon Tom Siebel, who now ranches in Montana, grew increasingly concerned about the state's growing methamphetamine epidemic. He has spent more than $5 million of his own money, and recently pledged more, on an unprecedented saturation ad campaign aimed at stopping meth experimentation in Montana.

SPRAWL AND TRAFFIC

While western Montana's population growth increases employment, wages, and the tax base, it also creates unwelcome problems such as traffic congestion and housing sprawl. Wildlife managers note that growing numbers of countryside homes, fences, and roads built around regional population centers are fragmenting wildlife habitat.

THE NEW WEST In Montana's changing landscape, mountain bikes now share roads with cattle, and traditional industries are stagnating as new ones such as health services grow rapidly.



Montana's new boom communities are raising other conservation concerns. Soil disturbed by new developments spreads harmful exotic plants, such as knapweed, that crowd out native vegetation. Birdseed and pet food attract nuisance bears, which often have to be killed. When new residents build along rivers and streams, they often raise the banks with boulders. That reduces flooding but also decreases periodic high water that carries fertile silt needed by young cottonwoods and other floodplain vegetation.

"No Hunting" signs are another problem. Many new ranch owners are closing their gates to the public hunting that has long been a Montana tradition. Their reasons range from wanting to maintain privacy and protect wildlife from harm to setting up pay-to-hunt operations. In addition to reducing hunting opportunities for locals, this hamstrings wildlife managers trying to help neighboring ranchers with elk depredation problems.

A common native Montana response to these and other concerns resulting from human population growth is to hope out-of-staters will stop moving here, so that Montana can return to "how it used to be."

That's unrealistic, says Miller, a fifth-generation Montanan whose father was a Butte miner. "Our state's population is aging, and we need more young workers. Besides, as in so much of the Rocky Mountain West, if people want to move here, they will. We can't close our doors. But we can manage the growth to maintain both the 'good ol' Montana' of cattle drives and Friday night football games while fostering the 'good new Montana' of more jobs and higher income."

If Montanans are smart, says Miller, "we can have our cake and eat it, too."

THE CHALLENGE

Having the best of both worlds won't be easy. For years, many Montanans have viewed nat-

Tom Dickson is editor of Montana Outdoors.

tural resources primarily as economic commodities to be logged or mined. These extractive industries are still important, says Miller, "but now it's clear that mountains and forests are also economic assets that attract people, businesses, and wealth to the state."

Swanson, of the Center for the Rocky Mountain West, notes that many Montanans traditionally looked at environmental protection and enhancement as the enemy of economic improvement. Not anymore.

"More and more communities are seeing that a healthy environment is essential for sustained economic prosperity," he says.

For instance, Gallatin County residents have approved a $10 million bond to preserve ranchlands. Missoula has acquired 1,500 acres of Mt. Jumbo for open space and elk wintering range. Lewistown is restoring Big Spring Creek, a scenic trout stream running through town. And, according to the Montana Smart Growth Coalition, many communities are now promoting clustered housing development, which consumes less open space and wildlife habitat.

Recognizing the importance of fishing to both new and native Montanans, courts continue to uphold the state's stream access law, which ensures that public rivers remain open to all anglers. And the 2005 legislature made permanent FWP's Habitat Montana Program, which pays landowners to not sell wildlife habitat and cattle range for housing, energy, and other development.

In a 2004 speech given in Boise, Idaho, U.S. Forest Service chief Dale Bosworth said that changing public values are forcing his agency to revise its approach to forest management.

"I think we're in a new [era]," he said. "The public is counting on us to provide wildlife habitat, clean air and water, natural beauty, and the opportunity to enjoy the outdoors—all that in addition to traditional opportunities to harvest timber and graze livestock. Can we deliver all those goods and services and values? Only if we manage the land for longer-term ecosystem health."

"MORE COMMUNITIES ARE SEEING THAT A HEALTHY ENVIRONMENT IS ESSENTIAL FOR SUSTAINED ECONOMIC PROSPERITY."

STEVEN AHLE

That's also the challenge for western Montana communities. To remain economically strong, says Swanson, they'll need to conserve wildlife, protect and restore healthy landscapes, and maintain public access. "In other words, not kill the goose that lays the golden egg," he says.

Eastern Montana faces a much different challenge. There, says Miller, towns need to recognize they have unique natural resources and find ways to market them to attract new residents.

RON BOGGS

GRASSLAND "GOOSE" The challenge to eastern Montana may be to market natural resources such as prairie wildlife and open vistas to attract residents.

"Montana's eastern plains communities offer abundant prairie wildlife, open vistas, clean air, healthy farmlands, and a safe and quiet rural atmosphere fast disappearing elsewhere in the United States," she says.

The small-town feel attracted Dana and Barb Schulz from their fast-paced life in Houston (population 2 million) to Hysham (population 281). In 2002 they bought and restored the Ace Hardware Store in the tiny hamlet, located along the Yellowstone River halfway between Billings and Miles City.

"We really wanted to get out of corporate America and own a small business in a small town," says Barb.

Business has been good. The Schulzes doubled revenue in their first two years of operation and have hired two employees.

"The people around here welcomed us with open arms," says Barb. Having both grown up in Great Plains states, "we wanted to get back to the wide, open spaces," she says.

In a crowded, urbanized nation, open space is becoming an increasingly valued commodity. Elsewhere, writes historian K. Ross Toole in *Twentieth-Century Montana: A State of Extremes*, "America grew by eating upon itself—by devouring space, by devouring land."

Can Montana learn from the mistakes of other states? If so, it may discover new ways to conserve its abundant space, land, and wildlife, protecting both its deeply revered traditions and its new economic prosperity.

The Montana Challenge project includes reports on demographics by George S. Masnick, Harvard University; economics by Larry D. Swanson, Center for the Rocky Mountain West; land use changes by Jerry Johnson, Montana State University; and fish and wildlife recreation and tourism by Cindy S. Swanson, USDA Forest Service. To read these and other reports and learn more about the Montana Challenge, visit fwp.mt.gov/tmc.

Getting to the Root of the Problem

BY GIL GALE

Roughly one hundred years ago, a family of settlers sowed some of the first alfalfa in the Bitterroot Valley. They'd carried the seed from Eastern Europe, sure it would be an essential foundation for their new life in the New World. The settlers were right: The alfalfa thrived in the fertile valley. But unfortunately, mixed in with the round alfalfa kernels the immigrants had carried across the Atlantic Ocean were seeds of a different plant. Decades later, it would drastically transform the open wild lands of Montana and much of the Northern Rockies.

The plant was spotted knapweed, an invader of uncommon aggressiveness and tenacity. This spindly, 3-foot-tall perennial with thin leaves and lavender thistlelike flowers thrives in open grasslands and under light canopies of ponderosa pine and Douglas-fir. Since the early 1900s, it has crowded out many native plant communities that had called Montana home since the glaciers receded 10,000 years ago. Neither wildlife nor most livestock eat it, so the invasive exotic species ruins big game habitat, songbird feeding grounds, and livestock forage. Also, because it inhibits the growth of native plants and creates a barren soil surface devoid of other vegetation, knapweed promotes soil erosion and runoff into streams and rivers.

EVIL THE WEEVIL This big-nosed insect has been wreaking serious havoc on knapweed.

JIM STORY

A Montana vegetation map from the 1920s shows knapweed only in Ravalli County. Today, the harmful invasive species dominates more than 4.5 million acres of valley bottoms, rangelands, and forest edges in every county of the state.

Knapweed moved across the landscape faster than people recognized how much damage it was doing. Long-time residents of the Bitterroot Valley say they only began noticing the plant in the 1970s, and then they assumed it was just a harmless newcomer. By the time they and others realized the seriousness of the problem, knapweed had gained a strong foothold. Many open areas once rich in a diverse array of native grasses and forbs have become knapweed monocultures.

The tenacious weed can be nearly impossible to eradicate. Landowners, agencies, and researchers have tried for years using various traditional control techniques, but each has its drawbacks. Herbicides, for example, require annual applications, and mowing won't work in mountainous terrain.

The most promising knapweed control method has come from a Montana State University agricultural research station near Corvallis, in the Bitterroot Valley. There, research scientist Dr. Jim Story has been working for more than three decades on a process known as biocontrol. Conducted for decades by land managers on other invasive species, biocontrol uses insects from a plant's native landscape to kill the species and control its spread. The great advantage of biocontrol is that it can sustain itself once established.

In the 1980s Story, working with several Canadian scientists, found one dozen Eastern European insect species that fed on knapweed seed heads or other plant parts. The bugs ate knapweed on test sites, but none of the species was aggressive enough on its own to reverse the weed's invasive tide on test land parcels.

Story decided he'd look for an insect that fed on the plant's root system. After several years of searching, he found a large, slow-moving weevil with a prominent snout and a voracious appetite for spotted knapweed roots. Four years of quarantined tests at a private research facility in Switzerland confirmed that *Cyphocleonus achates* fed solely on knapweed. What's more, once knapweed numbers declined, it would not switch to a diet of North American native plants—an essential requirement before a foreign insect can be released in the United States. In 1988, Story imported the first group of these insect colonists and released 25 adults in a thick patch of knapweed outside Corvallis.

For the first several years, the weevils killed some knapweed, but results were not dramatic. Then in 2001, Story was surprised to find a dramatic crash in knapweed populations at some initial release sites. At one 100-acre parcel, the knapweed infestation declined by 80 percent.

Over the past 15 years, Story has been breeding weevils then releasing them in the Bitterroot Valley. He also ships them throughout the Pacific Northwest to other breeding stations and release sites. He now raises 25,000 insects each year and hopes to double that amount. In 2005 he visited a site that 30 years earlier supported a dense, continuous cover of knapweed. The knapweed was gone. The only control had been the release of *Cyphocleonus* weevils a few years earlier. Story says that in recent years he has been receiving calls from landowners around the valley reporting a strange, large-nosed bug on fence posts, on the ground, and covering knapweed plants. Story now believes the number of weevils in the Bitterroot Valley has reached a critical mass, and that the biological control has begun in earnest.

Cyphocleonus, working alongside other insect predators, may finally prove to be the long-sought liberator of many beleaguered grassland plant communities in Montana.

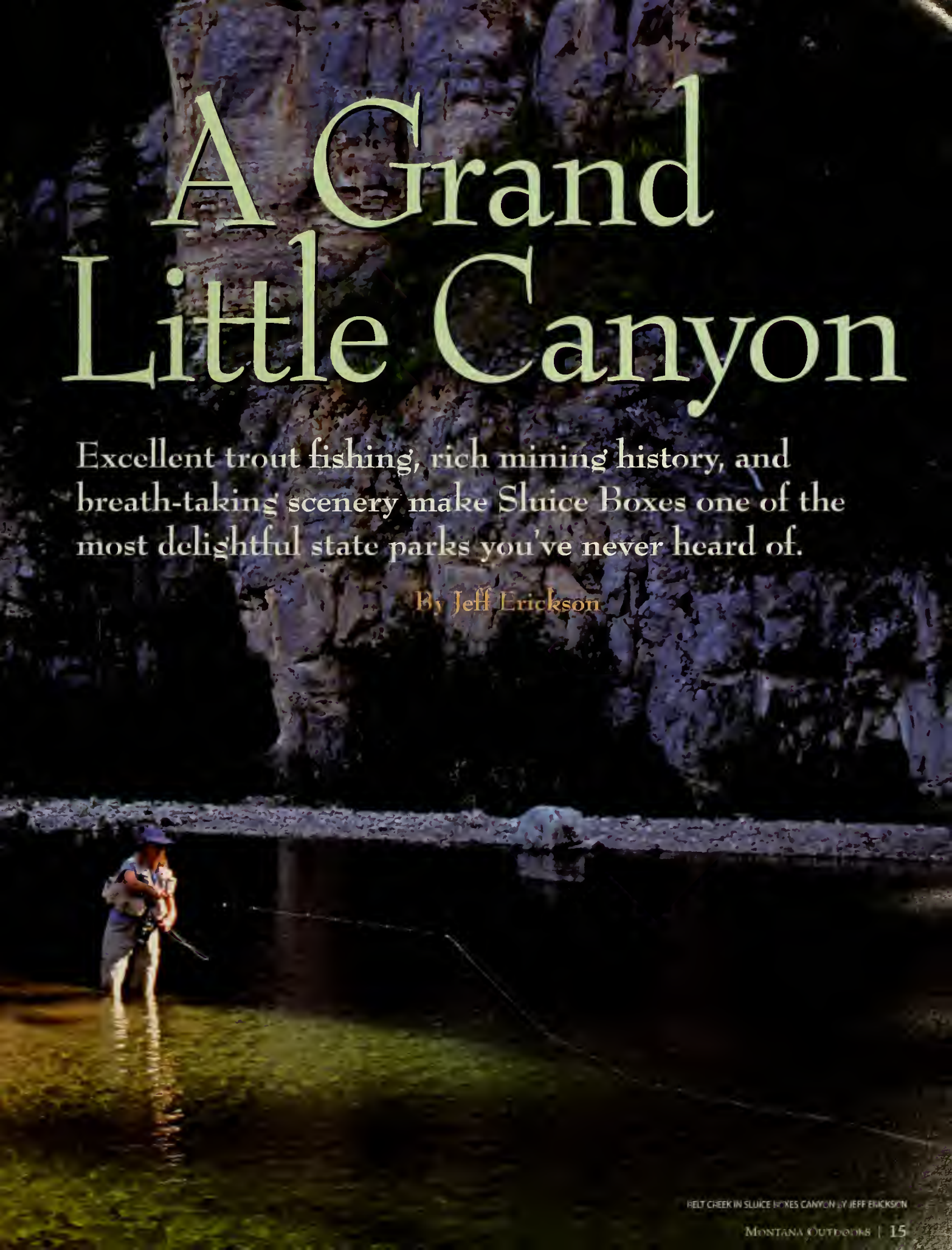
Gil Gale manages the Invasive Plants and Rangelands Program at the Bitterroot National Forest.

NOT JUST A PRETTY PLACE Belt Creek may be one of Montana's most scenic waters, but it also holds a healthy trout population. According to a 2004 FWP fish survey, Belt Creek's Sluice Boxes stretch held roughly 350 rainbows 8 inches or longer per mile. Fisheries crews didn't estimate the brown trout population, but they did find one specimen weighing 4 pounds, a reminder of the days when the Great Northern Railway's "Fish Train" carried anglers up the canyon from Great Falls.

A Grand Little Canyon

Excellent trout fishing, rich mining history, and breath-taking scenery make Sluice Boxes one of the most delightful state parks you've never heard of.

By Jeff Erickson



HELT CREEK IN SLUICE BOXES CANYON BY JEFF ERICKSON

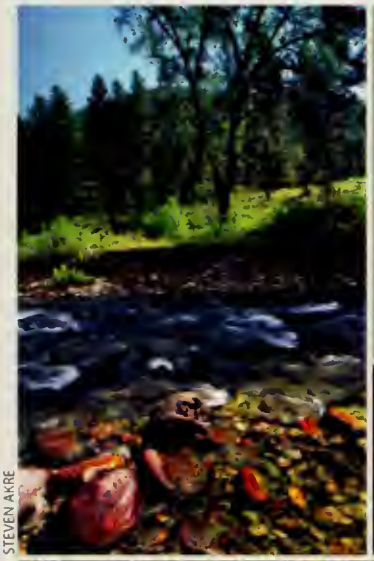
Beneath the soaring limestone cliffs of Belt Creek, I lobbed a heavy stonefly nymph into the frothy head of a riffle. I could feel the meaty fly tickle the boulders as it dropped into the fast, upper maw of the run, and I visualized its rubber legs twitching enticingly in the complex currents. The water drew the bug deep into the turquoise pool, where it continued to skip along the bottom.

Just upstream my wife, Mary, worked her Stimulator dry fly along the surface current seams created by the remnants of a massive railroad trestle. Earlier, we had noticed streamside rocks covered with the shed exoskeletons, or casings, of golden stoneflies. The Stimulator is a good imitation of this aquatic insect, which only lives in clean, cold streams.

Montanans have many templates for "the perfect trout stream," and I was convinced I had discovered mine. Belt Creek winds through the serpentine canyon of Sluice Boxes State Park, 30 miles southeast of Great Falls. The park is rich in history and geologic features, provides excellent hiking, and contains abundant wildlife. Of immediate interest to me was the creek's remote trout fishery—once considered among central Montana's finest and now on the rebound after decades of abuse from mining waste. In the early 20th century, the creek teemed with native westslope cutthroats up to 20 inches long. Later, introduced brown, rainbow, and brook trout established wild populations.

"Different sportsmen have their favorite streams, of course, but [Belt Creek is] probably the best of them all," reads an article from a 1914 issue of the local *Belt Valley Times*. "Two to three pound trout are not rare and include the native black spotted cutthroat."

After hurling out another cast, I heard Mary yell, "Check it out!" She had spotted Albright, the ghost town we had been searching for as we fished our way through the gorge. We reeled in and waded across to explore, ready to peel back a few layers of the state park's fascinating natural and cultural history.



STEVEN AKRE

"You can hear the boulders hitting each other as they move down Belt Creek."

ROCKY AND REMOTE Scenic Belt Creek sparkles as it tumbles over boulders. Along the canyon above the stream, visitors may find hidden mining buildings.

JEFF ERICKSON

Relatively unknown even to Montanans, 1,450-acre Sluice Boxes is a remarkable state park even by Montana's high standards. "I like to tell people I'm lucky enough to manage two of the nicest places in the state," says Sluice Boxes State Park manager Colin Maas, who also administers the nearby Smith River, a nationally known destination. As Mary and I scrambled up the bank to Albright, we couldn't agree more. Belt Creek's scenic ravine is a pretty kid sister to the Smith River canyon, located 20 miles to the west.

The park's central feature is Belt Creek, which rises from the flanks of 9,000-foot peaks in the Little Belt Mountains before flowing 80 miles north to join the Missouri River. The Lewis and Clark National Forest largely encompasses the stream's headwaters above the park, an area checkered with patented mining claims.

In its upper reaches, Belt Creek tumbles boisterously through a narrow mountain valley, past the old mining towns of Neihart and Monarch, before zigzagging through a deeply incised canyon. Dr. David Baker, a local earth scientist and educator, explains that the canyon continues to deepen during high water as Belt Creek "becomes a high-speed stream of liquid with abrasive particles carving deeper into the limestone. You can hear the boulders hitting each other as they move down Belt Creek."

The steep-sided canyon affords "spectacular views," says Maas, "like looking down into an abyss." The chasm's limestone walls are riddled with caves, where lucky visitors sometimes spot pictographs made centuries ago by Native Americans.

The canyon's name comes from its resemblance to the vertical sluice boxes that early placer miners used to settle out gold.

Below the Sluice Boxes, Belt Creek enters a buff-colored landscape of rolling hills, cottonwood valleys, large cattle ranches, and the historic coal-mining town of Belt. Between Belt and the Sluice Boxes, much of the creek disappears mysteriously into the underlying, crack-riddled Madison limestone, feeding one of the largest artesian aquifers in the country. According to Baker, a substantial volume of the "lost" water joins slow-moving groundwater from the Little Belt Mountains to emerge near Great Falls at Giant Springs State Park, where 156 million gallons of 54 degree water gush to the surface daily.

Set in a transition zone between the high plains to the north and the Little Belt Mountains to the south, Sluice Boxes State Park contains a wide range of habitats. Visitors will find cool, shaded rock walls next

Jeff Erickson is a freelance writer in Helena.

STEVEN AKRE

JEFF ERICKSON

JEFF ERICKSON

JEFF ERICKSON

MINIATURE MONTANA With its mountain scenery, mining history, and trout fishing waters, Sluice Boxes State Park is a microcosm of the state. Clockwise from top left: Belt Creek as it flows through the limestone canyon dubbed the Sluice Boxes; a lime kiln in the Albright ghost town; a rainbow trout held gently before release; a remnant of Neihart, established in 1882, which thrived briefly off trade generated by nearby sapphire and silver-lead mines.

to miniature waterfalls—luxuriant with ferns and moss—as well as open, sun-baked south slopes covered in prairie grasses and an occasional prickly pear cactus. Wildflowers abound in early summer, and various berries appear later. Bird watching can be excellent, and hikers occasionally see elk, mule and white-tailed deer, moose, mountain lions, black bears, and bobcats.

Wildlife were not on our minds as Mary and I stashed our fly rods under a pine and walked silently through the ghost town. We were thinking of the people who, more than a century ago, built and used the remnant limestone quarry, cabins, flumes, and mine carts scattered about the site. Towering above Belt Creek were the twin cones of a lime kiln once fueled by coal mined in Belt and hauled upstream by train. In the late 19th century, this was a bustling place, but the only souls in Albright today are occasional park visitors who reach the site after hiking or floating through the canyon.

By 1890 a small town had grown up next to a quarry established by William Albright, eventually home to approximately 500 residents. In 1911, Amalgamated (Anaconda) Copper Company bought the quarry and shipped tons of limestone each day by rail to Great Falls, where it was used as flux in a smelter. A neighboring sawmill was kept busy with logs that were floated down nearby Logging Creek during high water.

We paused on the rail bed carved into the hillside, old ties scattered helter-skelter. The rail bed, a critical element in the Sluice Boxes' history, was the Belt Mountain Branch Line of James J. Hill's Great Northern Railway. Now used by hikers to access the canyon, the rail spur was completed in 1891 and connected the Great Falls smelter with the upstream lead, zinc, and silver mining districts opened a decade earlier. Snaking 56 miles up Belt Creek into the mountains through the seemingly impassable Sluice Boxes, the line was an engineering marvel. The dangerous construction, completed with the help of Chinese crews, required a right-of-way blasted from sheer cliffs, as well as the construction of enormous rock retaining walls, dozens of trestles, and several tunnels.

Always on the lookout for new ways to reach fishing waters, anglers took advantage of the new rail line. In 1914, the Great Northern began running a Sunday morning "Fish Train" out of Great Falls. Angling parties rode the train to their favorite canyon reaches. In the evening, often with full creels, they caught the return run back to Great Falls.

MONTANA HISTORICAL SOCIETY

TROUT TRACKS The Great Northern Railway's "Fish Train" hauled anglers from Great Falls to Belt Creek in the early 19th century. By the time the line closed in 1945, the creek had been ruined by mining waste.

JEFF ERICKSON

Fishing wasn't the Sluice Boxes' only draw. In the early decades of the 20th century, visitors took the Belt Mountain Branch Line to camp, picnic, and view mountain scenery. Other attractions were summer cabins, a guest ranch and dance hall at Logging Creek, and baseball games in Neihart.

The last train labored through the Sluice Boxes in 1945. By then, most of the mines in the upper basin had closed because of falling metal prices. The tracks were pulled the next year.

The mining that opened up Belt Creek to recreational use also poisoned the stream's waters. As in so many Montana streams, acid and heavy metals had leached from the mines and killed the aquatic insects that fish need to survive. Trout numbers plummeted. A 1936 issue of the *Belt Valley Times* noted that Belt Creek "was for many years the fishermen's paradise. However, the tailings from the mine concentrators have so polluted the waters that the fishing tribe is no longer evident."

Baker, whose father was a depot agent on the railroad, says when he visited Belt Creek as a boy in the 1940s, "the water was running milky gray." The river, however, has slowly begun to recover. Baker says occasional floods like a big one in 1953 have helped scour polluted mining tailings from Belt Creek's streambed.

"I've seen a dramatic improvement in Belt Creek's water quality since the end of World War II," he says.

Scott Brown, the federal Environmental Protection Agency's (EPA) local project manager, also has been impressed with the creek's ability to begin a slow recovery on its own.

"Belt Creek is thriving pretty well in spite of all that has happened up above in the watershed," he says.

A significant factor has been the watershed's limestone geology. The springs emanating from the abundant limestone in and around the Sluice Boxes are highly alkaline. This buffers acidic mine drainage and helps keep toxic metals in a less-dangerous solid form. The limestone geology also adds calcium to the water, enhancing the growth of aquatic insects and the trout that eat them. The combination of limestone, springs, and abundant tributaries has given Belt Creek the capacity to bounce back from decades of abuse.

Travis Horton, the FWP fisheries biologist who manages Belt Creek, says the stream's trout fishery compares favorably with that of the famous Smith River. Though most of the remaining westslope cutthroats in Belt Creek have hybridized with rainbow trout, some of the stream's tributaries contain pure or almost pure cutthroats. These fish are considered genetic reservoirs for attempts by FWP and federal agencies to conserve and restore cutthroat populations elsewhere in the upper Missouri River basin.

All this, however, does not mean the Belt Creek watershed is ecologically healthy. In 2001 the EPA placed two mining districts in upper Belt Creek, encompassing dozens of inactive mines, on its Superfund cleanup list. Some tailings have been moved to sealed repositories, where rain and spring runoff don't wash the polluted mining waste downstream. But full recovery of Belt Creek will require millions of dollars and a long-term commitment by public agencies.

Despite the lingering toxins, the creek and its surrounding wonders offer recreation for a new generation of anglers, hikers, and wildlife watchers. As crimson light faded from the canyon walls, Mary and I reluctantly hiked the old rail grade back toward the truck. Though eager to hit the brewpub in Belt, we just couldn't resist a few more casts into the creek on the way back. Withstanding such temptation is difficult in the Sluice Boxes.

At a fishy-looking run, I cast my stonefly nymph and let it bounce along the edge of some trestle debris. Gazing at the old rail bed above me, I happened to look down just as my indicator shot under. I raised the rod sharply and was in to something heavy and solid, moving downstream like a resurrected ghost from the old Fish Train days.

To read more about Belt Creek's mining history, visit fwp.mt.gov/mtoutdoors/webextras.htm.

If you go: SLUICE BOXES STATE PARK

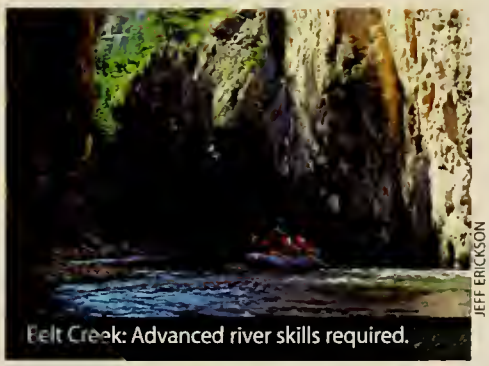
Montana FWP acquired Sluice Boxes State Park in 1974 and subsequently designated it as a "primitive" park. That means few amenities, rustic conditions, and unspoiled scenery.

LOCATION: The primary entrance to Sluice Boxes State Park is at the Riceville Bridge, 8 miles south of Belt on U.S. Highway 89, then a half-mile west on the Evans–Riceville Road. (It's also possible to access the upper park where Logging Creek Road crosses Belt Creek. However, there are no facilities here, parking is along the road, and visitors must take care to avoid adjacent private property.)

FACILITIES: The only facilities are a parking lot, vault toilet, park map, and a trail following the abandoned rail grade into the park's interior.

KAYAKING AND RAFTING: The stream requires advanced rafting or kayaking skills. During high water in early summer, the Sluice Boxes can be a treacherous death trap for the unwary or inexperienced. And by midsummer, the water is often too low to float.

HIKING: Hiking is available along the old rail bed. Park manager Colin Maas cautions that most of the old rail trestles are down, requiring hikers to scramble along rocky areas in places. The trail is not maintained and in many places requires crossing Belt Creek. Hikers should be in good shape and bring rain gear, footwear for stream crossings, a topographic map, and plenty of food and water. Also, hikers should watch for poison ivy.


JEFF ERICKSON
Belt Creek: Advanced river skills required.

Reaching the central gorge on foot can be dangerous during spring runoff. Plan hikes into the Sluice Boxes from mid-July through October, when safe fords are more predictable. When flows permit, the entire distance from Riceville to the Logging Creek Road bridge can be covered in a day. The canyon between the two bridges encompasses 7.5 river miles and requires 12 fords.

CAMPING: There are no designated sites in the park, but backcountry camping is allowed by permit. Maas is trying to foster a leave no trace ethic among park users. He asks visitors to pack out all garbage, camp away from the creek, and use stoves, fire pans, or grills rather than open fires. "Because the park is such a gem, it requires a high level of stewardship," says Maas. "We're always looking for volunteers to help us keep it clean." ■

A whisker away from winking out

Will the pallid sturgeon go extinct on our watch?

By Andrew McKean

PALLID STURGEON PHOTO & ILLUSTRATION BY EDDIE RYDARI

Frazer Rapids is a quarter-mile of swift, complicated current created by a gravel shoal extending across the otherwise languid Missouri River some 20 miles below eastern Montana's Fort Peck Dam. For boaters trying to negotiate this stretch of the Missouri, these rapids are a stomach-knotting, hull-scraping stretch of water. However, for a pallid sturgeon, among the rarest animals in North America, the swirling, tea-colored shallows may be one of the few remaining natural river features preventing its extinction.

Biologists suspect the bottom-dwelling native fish congregate on this gravel bar in the spring to spawn. But they don't know for sure. Nor do they know if the pallid sturgeon, listed as federally endangered in 1990, would reproduce if it could reach vital spawning habitat on the nearby Yellowstone River. They also don't know how many adult pallid sturgeon remain and, of these, how many are still reproductively viable. Also unclear: Even if adult pallids can reach the right habitat for spawning, can their small offspring survive in an

altered river system that may be sentencing them to a premature death?

Biologists working with pallid sturgeon not only lack information, they also lack time. Most remaining wild pallids were teenagers during the Eisenhower administration. Like humans of the same generation, the ability of these aging fish to reproduce diminishes every year. So few fertile pallids remain in the wild—perhaps just a few hundred—that scientists say the species will likely become extinct within the next 15 to 20 years.

"Unless things change," says Chris Hunter, chief of the Montana Fish, Wildlife & Parks Fisheries Division, "we could see the pallid sturgeon disappear in our lifetime."

Armor-plated, bewhiskered relics of the Jurassic Era, pallids are one of eight sturgeon species in North America. Named for their pale complexion, these slow-growing, shark-shaped fish live in portions of the Missouri, Mississippi, and lower Yellowstone rivers. The pallid sturgeon's stronghold, if it can even be called that, is in eastern Montana and western North Dakota. Roughly 150 adults live below Fort Peck Dam near the Missouri River's confluence with the Yellowstone; another 30 to 50 remain in the Missouri above Fort Peck Lake. Biologists fear that this relative handful of fish represents the last link in a 200-million-year-old chain extending to an age when dinosaurs roamed the continent.

Biologists don't know more about pallid sturgeon because the fish's behavior and habitat resist scrutiny. Adult pallids, which can grow to 5 feet long and weigh over 60 pounds, live on the murky bottoms of some of the nation's largest, most remote rivers. They so closely resemble their cousins, the smaller (and far-more-numerous) shovelnose sturgeon, that pallids weren't even described as a separate species until 1905. During the century that followed, their habitat was damaged or eliminated as rivers were dammed, diverted, and channelized to reduce flooding, generate power, provide drinking water, and float Midwestern barges. This reduced the self-sustaining pallid population to just a handful of geriatric individuals likely born before the dams were built. For biologists, simply finding a single pallid sturgeon these days—much less a group of them—is cause for celebration.

"One reason we know so little about these sturgeon is that we're limited to studying a small population of old adults," says Dave Fuller, an FWP fisheries technician studying pallids and other native fish of the lower Missouri. "We have almost no information about the early life history of these fish, their spawning, or the larval and juvenile stages. We're inferring about their whole life history from just a handful of adults that get older and less reproductively viable every year."

The main cause of the species' demise is no mystery. Monolithic Fort Peck Dam in eastern Montana, North Dakota's massive Garrison Dam, and three smaller dams in South Dakota and Nebraska have drastically altered the Missouri River. Many of the habitats and hydrological conditions that pallid sturgeon need to survive no longer exist.

Before the Missouri River dams were built, beginning in the late 1930s, the river typically swelled each spring with mountain snowmelt, sprawled across its wide floodplain, and flowed warm and muddy to its union with the Mississippi River at St. Louis. Pallids evolved with the ebb and flow of high-water cycles. They moved hundreds of miles upstream each spring during high water to sandy shoals and riffles in the main river. The sticky fertilized pallid eggs would drop to the river bottom and adhere to rocks and gravel for a few days as the embryo developed. When the embryonic sturgeon were still in the larval stage, they would detach from the substrate and drift in the current for up to two weeks and over hundreds of miles. During this journey, the tadpole-shaped sturgeon developed tails, which propelled them to slack-water estuaries. There, they ate zooplankton, then insects, then minnows as they grew older. After a dozen years, when the sturgeon finally reached sexual maturi-

COPEIA, 1955

LAST OF THE BIG ONES? A 66-inch-long, 38-pound pallid sturgeon caught at the mouth of the Tongue River in 1950. Biologists say fewer than 200 adult pallids now remain. Before long, the fish may be too old to reproduce.

Most remaining wild pallids were teenagers during the Eisenhower administration.

Andrew McKean manages FWP's Regional Information and Education Program in Glasgow.

ty, they would join the springtime spawners and perpetuate the life cycle.

Dams changed all that by blocking the upstream spawning migration of pallids and other native fish. Just as harmful was the U.S. Army Corps of Engineers' water management regime, which tamed floods. Floodwaters once scoured the river bottom and deposited sand and gravel in shallow spawning shoals. High water also inundated side channels where young sturgeon grew up. And instead of the historically warm water that cued the sturgeon's springtime spawn, the dams released a consistent flow of cold water from the reservoir bottoms.

Perhaps most harmful to the pallids was how the dams chopped the river into relatively short segments. For instance, the Missouri River below Fort Peck Dam flows only about 200 miles before it slows and becomes North Dakota's Lake Sakakawea. River stretches below other dams are even shorter. That's not enough river miles for a larval pallid sturgeon to drift downstream before it matures.

According to Dr. Pat Braaten, a U.S. Geological Survey fisheries biologist studying pallid sturgeon, if the larvae don't have ample time to grow a tail to propel themselves, they sink to the reservoir bottom and smother in silt.

"We're increasingly sure that this 'drift distance' is critical to the pallid's recovery," says the biologist.

In 2003 Braaten's crew discovered a single days-old larva drifting just downstream of the Missouri–Yellowstone confluence. It was evidence that adult pallids somewhere upstream had naturally spawned. The spawning may have taken place at Frazer Rapids or Prairie Elk Rapids, which biologists suspect are the Missouri River's equivalent of sturgeon singles' bars. Their discovery renewed hopes that at least some adult pallids are still spawning. If true, that means larvae survival, not spawning habitat, is the most important factor affecting the species' recovery.

To create adequate larvae survival conditions on the Missouri would require releasing warm, muddy water over the Fort Peck Dam's spillway. This would replace the cold water now coming from the dam's base, which keeps adult sturgeon from moving

"We're increasingly sure that this 'drift distance' is critical to the pallid's recovery."

DWINDLING RANGE
Pallid sturgeon once moved up the entire Missouri River to Great Falls, and the Yellowstone River to its confluence with the Bighorn River.

WATER DISRUPTIONS
Fort Peck and other major dams on the Missouri River prevent upstream migration, lower water temperature, and drastically reduce vital spring flooding.

farther upstream to spawn. More warm water would effectively add miles of river available to adult spawners—and, after the eggs hatch, to larval sturgeon for downstream drifting. "Spillway releases" have been tried on other rivers in the United States and appear to benefit other sturgeon species. However, no spillway release can occur at Fort Peck Dam until the lake's water rises to full pool, which is at least five years away in these drought-stricken times.

Roughly 100 air miles southeast of Fort Peck Dam, the lower Yellowstone River braids and weaves, carving islands, building sand bars, and occasionally flooding lazy side channels before joining the Missouri just inside the North Dakota border. This 290-mile stretch of the Yellowstone is one of the last reaches of unimpounded, unchannelized river in the Northern Plains. Biologists think it is perfect pallid sturgeon habitat, both for spawning and larvae survival, where the species could rebound to a sustainable population.

However, no one knows for sure if sturgeon would use that part of the Yellowstone. A 5-foot-tall diversion dam at Intake, near Glendive, blocks fish from moving upstream, where all this habitat lies. Biologists have released some radio-tagged sturgeon upstream from the dam to see what habitats the fish would use. Most of the pallids soon swam back downstream to below Intake, leaving biologists puzzled.

Built in 1911, the Intake Diversion Dam is a major source of irrigation water for far-eastern Montana and western North Dakota. Though the Yellowstone is often touted as America's longest "undammed" river, the Intake dam is large enough to prevent sturgeon from moving upriver. In midsummer, the dam also diverts about half of the entire Yellowstone River into irrigation canals. Though the water is essential for farming in the arid region, the dam also diverts thousands of downstream-swimming fish of various species from the Yellowstone and strands them in canals or on irrigated sugar beet fields.

Most people involved in the pallid sturgeon's recovery agree the biggest impediments are the loss of habitat, migration barriers, and historical water flow disruption. But that consensus is tempered with political reality. The kinds of large-scale engineering alterations required to return either the Missouri or the Yellowstone rivers to their historical condition are economically, socially, and politically unlikely.

For example, suggestions to alter the spring water releases from Fort Peck Dam have been met with howls of protest from downstream states demanding steady flows

for barge traffic. And then there's the matter of cost. At the Intake Diversion Dam, the U.S. Fish & Wildlife Service is currently evaluating various options that would allow upstream-moving fish to move around the structure and reduce the diversion of downstream-moving fish into irrigation canals. However, no agency has agreed to foot the $35 million to $50 million bill for building a dam passageway.

Until state and federal agencies can find ways to make substantive habitat improvements, either by modifying dams or changing water-release regimes, the only hope left for pallid sturgeon is to augment the dwindling population of old, wild fish with hatchery-reared progeny.

Biologists are using Montana fish as the crucible of genetic identity that could rejuvenate the pallid population. Every spring for the past eight years, fisheries crews have descended on the confluence of the Missouri and Yellowstone rivers in April to net the adult pallids that congregate there. The biologists carefully transport the sexually mature fish to hatcheries, strip eggs and milt, and then incubate the fertilized eggs. Once the eggs hatch and the young fish reach 3 to 7 inches long, biologists mark them with tags and release them into the two rivers. In 2005, biologists released a record 15,000 hatchery-reared juveniles. Based on the recapture of previous years' tagged fish, it appears the juvenile pallids are able to survive and grow in the wild. However, if wild fish can't find conditions for adequate spawning and larvae survival, it's unlikely the hatchery fish will either.

"We're buying time with the hatchery program," says Braaten. "We're trying to buy a generation of fish while we study the sturgeon and work on habitat alteration so some future generation of hatchery-reared pallids can spawn naturally."

Biologists admit they may not figure out what pallid sturgeon need to reproduce naturally—or be able to remove barriers to spawning success—before the remaining wild fish become too old to reproduce. George Jordan, the pallid stutgeon recovery coordinator for the U.S. Fish & Wildlife Service in Billings, believes the stocking program is essential for preserving the species' genetic identity.

"Through the hatchery system, we're making families of pallid sturgeon with the hopes of conserving the pallid's genome with as much diversity as possible," Jordan says. "Maybe in the future, someone will wake up in the middle of the night with an idea about how to improve sturgeon habitat so these and future hatchery-raised fish can spawn and live on their own. The alternative is that we do nothing and the pallid sturgeon just winks out."

Yet another reason for stocking sturgeon is that the hatchery fish could take advantage of some unforeseen event—natural or human-caused—that provides adequate spawning and larval survival. Though most biologists suspect the remaining wild pallids were all born before construction of Fort Peck Dam, Braaten thinks some successful natural reproduction might have occurred since the dam was built.

"One [study] does suggest that some spawning occurred in the 1940s, '50s, and '60s and the babies from these spawns recruited to adults," says Braaten. "Something may have happened during each of those years, maybe a flood event or some other environmental feature, that was just right for sturgeon to pull off a spawn. If we can learn what it was, maybe we can duplicate it, or it will happen again natutally. That's the best argument for stocking as many hatchery fish as we can. If we get another flood or some other event that creates the right habitat conditions that can produce natural spawning, then we have hatchery fish in the river ready to take advantage of it."

Even if scientists can't solve the pallid puzzle, Fuller doesn't believe the years and money spent on sturgeon recovery will have been in vain. He notes that the Corps of Engineers has agreed to release some water under certain conditions from Gavins Point Dam in southern South Dakota to encourage sturgeon spawning runs downstream.

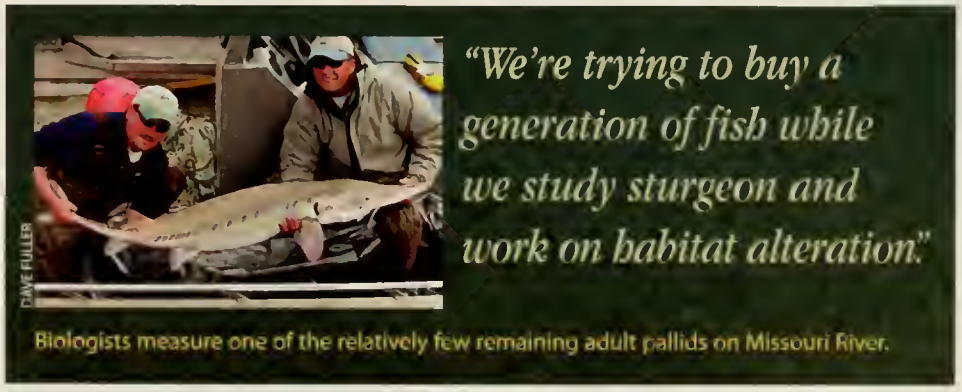
The federal agency has also committed millions of dollars to re-create shallow-water pallid sturgeon habitat on the lower Missouri River in Missouri. There, where most of the few remaining pallid sturgeon have cross-bred with shovelnose sturgeon, genetically pure pallids are in grave danger of disappearing.

"It's taken a while for people to get serious about pallid sturgeon," Fuller says. "But things are starting to move. Fifteen years ago, the Corps of Engineers wouldn't have considered releases from Gavins Point Dam just to benefit a native fish. Even ten years ago, you didn't see this kind of attention being paid to collecting fish for hatchery augmentation."

Fuller believes the research done to learn why this species has been disappearing will also benefit other fish.

"Pallids are an indicator species for a warmwater ecosystem gone wrong," he says. "What we are learning from these sturgeon may prevent other Yellowstone and upper Missouri native species, such as paddlefish, blue suckers, and sauger, from following them to extinction."

That may be minor consolation when compared to the absolute finality of seeing the pallid disappeat forever. But considering how dire the sturgeon's plight is, how little anyone knows about the species, and the massive obstacles threatening its recovery, holding out hope for other warmwater fish might be all there is left.



Biologists measure one of the relatively few remaining adult pallids on Missouri River.

HOLDING OUT HOPE FWP fisheries technician Matt Baxter shows off a hatchery-reared juvenile pallid sturgeon before releasing it into the Missouri River. Because so few wild pallids remain, biologists hope the hatchery fish will survive and, if habitat conditions improve, someday reproduce on their own.

ANDREW MCKEAN

RIPE AND READY Mike Ruggles, FWP fisheries biologist at Fort Peck Lake, prepares to strip a netted female walleye of her eggs. The eggs are then mixed with milt stripped from male walleyes and taken to a warm-water hatchery. Each year, more than 100 volunteers help FWP harvest roughly 90 million eggs from Fort Peck walleyes. Once hatched, the tiny fry go back into the lake and other walleye waters across the state.

Hatchery Pride

Essential for warmwater fisheries, mountain lake fishing, and protecting some endangered species, FWP's fish-rearing facilities have plenty to boast about. By Dave Hagengruber

Listening to Jim Drissell talk as he stands over the concrete raceway, feeding the fish at Big Springs Hatchery near Lewistown, I'm reminded of a proud teacher watching his students graduate from school and head off into the world.

"When our hatchery crew loads these fish onto the trucks in the spring, that's the end of the line for us, the conclusion of an entire year's work," says Drissell, who has spent the past 20 years working in various Montana state hatcheries. "I like to think that every one of the fish we raise here is eventually caught by someone and that it puts a grin on their face."

I ask Drissell if he thinks people catching these fish realize they came from a hatchery.

"Some of them might know that, although most people probably don't," he answers. "And even if they know it's a hatchery fish, they might not want to tell anyone, especially if they show off their fish pictures to friends. I guess it's not cool to admit you caught a hatchery fish."

That's an indication of the reputation fish hatcheries have earned in Montana over the past few decades. Like an odd family relative no one wants to acknowledge, hatcheries are a part of Montana's fisheries management program that some anglers prefer to ignore. Yet just like the rarely seen cousin who turns out to be a benevolent millionaire, Montana's hatcheries contribute enormously to the state's fisheries.

"We're real proud of our hatchery system," says Chris Hunter, chief of the Montana Fish, Wildlife & Parks Fisheries Division. "The science of hatcheries has evolved over the decades along with other fisheries sciences to meet new demands from biologists and anglers. Hatcheries are responsible for providing tremendous fishing opportunities. They also help us maintain the gene pool of recovering fish populations such as native cutthroat trout and restore threatened and endangered fish species such as pallid sturgeon."

Hatchery evolution

From the time Montana's first hatchery opened in 1889 until the first fisheries biologist was hired in 1947, most of the state's fish management centered on rearing and stocking non-native fish such as rainbow, brown, and brook trout. Driven by the belief that fishing improved as stocking increased, Montana endeavored to produce and plant as many trout as possible.

The growing number of science-trained biologists hired by the state in the mid-20th century soon began to question whether stocking was all it was cracked up to be. By the

DAVE HAGENGRUBER

1970s, FWP biologists had discovered that stocking trout into high-quality habitat depressed populations. As a result, the department discontinued stocking trout into most rivers, relying instead on natural reproduction to sustain wild populations. But that did not mean the state abandoned its hatcheries.

"We've been so successful with our wild trout program over the past three decades that many anglers don't even realize Montana still maintains an essential and successful hatchery system," says Hunter. "As important as wild fish are, we can't afford for a second to overlook our hatcheries, what they provide, and how they have evolved into one of our most important fish management tools."

Today FWP operates ten fish hatcheries, nine owned by the state and one owned and operated in cooperation with the U.S. Army Corps of Engineers. Each year, the state's eight coldwater hatcheries produce roughly 9 million trout and salmon for stocking into nearly 500 lakes and reservoirs. The two warmwater hatcheries annually produce about 40 million to 80 million walleyes, northern pike, crappies, tiger muskies, catfish, and largemouth and smallmouth bass. These warmwater fish are planted in more than 120 lakes and reservoirs across Montana. This spring, the newly completed Fort Peck Multi-Species Fish Hatchery (see sidebar, facing page) began producing walleyes and other warmwater fish.

Brood and production

Montana has two types of fish hatcheries. *Brood hatcheries* maintain adult warmwater or coldwater fish that produce fertilized eggs. The eggs are then transported to *production hatcheries*, where they are hatched. The tiny newborn fish, called fry, are then raised to the size ordered by biologists for stocking. The most common size of trout they request is between 3 to 6 inches long, which takes about one year to grow. Most of the warmwater fish, especially walleyes, are stocked as mosquito-sized fry or as 2-inch-long fingerlings.

BUSY STATEWIDE Checking incubation trays and scrubbing raceways at the Yellowstone River Hatchery. Below: Monitoring westslope cutthroat trout at the Washoe Park Hatchery.

DAVE HAGENGRUBER

"We can't for a second overlook how our hatcheries have evolved into one of Montana's most important fish management tools."

DAVE HAGENGRUBER

In pounds, trout are the hatchery system's major product. But in numbers, the hatcheries produce more walleyes than any other species. Of the 46 million fish produced in 2004, more than 40 million were warmwater species, 39 million of which were walleyes.

Mike Ruggles, FWP Fort Peck Lake biologist, explains that those high stocking numbers can be misleading.

"In Fort Peck alone, we stock 20 to 30 million walleye fry and just under 2 million fingerling walleyes," he says. "But those fry are tiny and are in the hatchery just a few days before release."

To collect walleye eggs and milt for the warmwater hatcheries, Ruggles, his crew, and more than 100 volunteers work with

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Dave Hagengruber coordinates FWP's Aquatic Education Program.

hatchery personnel to net ripe, ready-to-spawn Fort Peck Lake walleyes. In a typical year, they harvest 80 million to 100 million eggs from these fish.

Ruggles has found that about 80 percent of the walleyes taken by anglers in Fort Peck Lake came from hatcheries. "Clearly, without hatcheries the fishing opportunities here would be seriously reduced," he says.

Ruggles notes that Fort Peck lacks the rocky bottom substrate found in natural Canadian lakes that walleyes need to spawn. "So we collect the eggs, hatch them in a controlled environment, then return the fry or fingerlings to the reservoir," he says. "Then it's up to the fish and nature to do the rest. Good fishing in a reservoir also depends a lot on environmental conditions."

Still waters get stocked

Although Montana discontinued stocking trout in most rivers and streams in the 1970s, there remains a great demand for stocked trout in waters where fish can't reproduce naturally.

"Ponds, reservoirs, and mountain lakes depend almost entirely on hatchery-raised fish," says Bob Snyder, FWP's new Hatchery Bureau chief. "Many high mountain lakes have harsh environmental conditions that slow fish growth. Viable trout populations wouldn't exist there without supplemental stocking from hatcheries."

The mountain lakes that FWP stocks generally receive fish every five to eight years, enough to maintain population levels that provide good fishing. "When you see those pristine waters and the beautiful fish that come out of them," says Snyder, "you'd never know those fisheries depend almost entirely on hatchery trout."

In the early days of the hatchery system, stocking mountain lakes meant loading milk cans filled with water and fish onto the backs of mules for hours or even days of travel into the backcountry. Today, helicopters stock fish directly into lakes, sometimes after flying just a few minutes.

In some cases, FWP workers take adult trout or their eggs from mountain waters, such as Goose Lake in the Absaroka-Beartooth Wilderness Area, back down to

ANDREW MCKEAN

FISH FACTORY Hatchery manager Andrew Ollenburg outside the new $19 million Fort Peck hatchery. Ollenburg says walleye anglers and local community boosters lobbied hard to get the facility built.

The Crown Jewel

By Andrew McKean

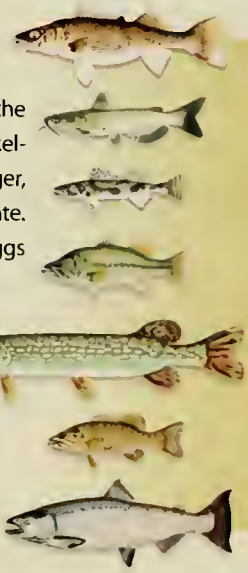
The Fort Peck Multi-Species Fish Hatchery, completed in January 2006, is a high-tech aquaculture factory equipped to incubate and rear fish at levels never seen before in Montana. With its hundreds of valves, miles of water pipe, and panels of computer circuitry, the interior of the 22,000-square-foot, $19 million facility looks like a gigantic nuclear submarine. Its main pump, which draws water from a series of ponds formed when Fort Peck Dam was built, is large enough to serve a fair-sized city.

"The Fort Peck Hatchery is by far the largest and most technically sophisticated facility in our hatchery system," says Chris Hunter, FWP's Fisheries Division chief.

The hatchery sits just off the Missouri River below Fort Peck Dam on roughly 100 acres of land leased from the U.S. Army Corps of Engineers. Nearly 96 acres is devoted to rearing ponds, which can raise more than 3 million walleye fingerlings each year. Those fish, along with 50 million walleye fry produced annually, will allow the hatchery to sustain Fort Peck Lake's recreational walleye fishery.

The massive facility requires only four staff members. A computer monitors the complex system that regulates water flow and temperature. Hatchery manager Andrew Ollenburg says the computer will instantly adjust the system the moment problems occur.

"Let's say a valve cracks," says Ollenburg. "The computer immediately figures out whether to speed up the pump and by how much, and then it adjusts pressure to all the other valves. That's great for efficiency."



Each vat inside the new building has three different water sources. "That gives us the capability to grow almost any species of freshwater fish imaginable," says Ollenburg. In addition to walleyes, the facility will produce northern pike, tiger muskies (a northern pike–muskellunge cross), smallmouth and largemouth bass, channel catfish, sauger, and Chinook salmon for stocking in lakes and reservoirs around the state. The hatchery will also rear endangered pallid sturgeon, incubating eggs collected from adults netted downstream on the Missouri.

The hatchery would not exist if not for walleye anglers, community boosters, and other members of Citizens for a Fort Peck Hatchery, which conducted meetings, lobbied politicians, and raised money. The angling advocates first taxed themselves, convincing the 1999 Montana legislature to approve a $5 Warmwater Stamp (now required by anglers who fish waters stocked with warmwater fish). Then the citizens' group worked with the state's congressional delegation to find federal funds to build the structure. Stamp revenue now helps cover the hatchery's operations and maintenance costs.

The Fort Peck Multi-Species Fish Hatchery will be dedicated on July 6, in conjunction with the annual Governor's Cup Walleye Tournament. Because roughly four out of five walleyes caught in Fort Peck are hatchery fish, future winning tournament teams will likely be able to credit walleyes from the Fort Peck Hatchery for their success.

GARY BEELER

FUTURE FISHERIES Rainbow trout fingerlings swarm for food pellets at the Bluewater Springs Hatchery at Bridger. A bag of hatchery-reared pallid sturgeon fry is readied for release in the Missouri River.

ANDREW MCKEAN

"The negative picture of crowds of anglers jostling to catch a bunch of pale hatchery stockers—that just doesn't apply at Canyon Ferry. These are big, hard-fighting rainbows you can't tell apart from the wild fish."

hatcheries. These fish become the genetic base that FWP uses to help recover native trout populations elsewhere in Montana. Goose Lake provides the pure-strain Yellowstone cutthroats that Jay Pravacek, manager of the Yellowstone River Trout Hatchery near Big Timber, is using in a four-year process to develop brood stock.

He and his crew head up to the lake in late July after ice-out. They capture fish spawning in the lake's tributaries, then take the fertilized eggs back to the hatchery. Like other brood hatchery managers, Pravacek takes pains to ensure the genetic purity of his brood fish and the approximately 200,000 trout produced at his hatchery each year.

"These cutthroats are a part of Montana's natural heritage," he says. "They are important for that reason alone."

Maintaining genetically pure stocks in hatcheries can also help keep a species from being listed as federally endangered. When the U.S. Fish & Wildlife Service considers a species for listing, it looks at the genetic integrity of various populations. Impure populations may not be tallied as part of the overall number. Because Montana wants to keep species off the threatened and endangered lists to maintain state management authority, "it's vital for us to be sure we have the purest brood stock we can obtain," Pravacek says.

Hatchery genetics also play a role in saving near-extinct species. Over the past ten years, FWP has stocked the Yellowstone and Missouri rivers with hatchery-reared pallid sturgeon, a federally endangered species. Due to dams, pallids no longer have adequate spawning and rearing habitat. Stocking sturgeon preserves the pallid's unique genetic identity as well as the hope that eventually the hatchery-reared fish will be able to spawn in natural conditions.

Saving species from extinction may be the noble role of Montana's hatcheries, but providing good ol' recreational fishing is still their primary function. No place is that more evident than on Canyon Ferry Lake near Helena. There, FWP biologist Steve Dalbey relies on the hatchery system to provide roughly 300,000 rainbow trout 6 to 8 inches long—nearly two dozen truckloads—each year. Hatched and reared at the Big Springs Hatchery in Lewistown, the trout are stocked each spring and fall.

"People shouldn't confuse this with the put-and-take fisheries that exist in many other states," says Dalbey. "Those hatchery fish are often caught by anglers later the same day they are stocked. Our upper Missouri River reservoirs are completely different. We have ideal growing environments for fish, and the trout we put in at 8 inches this year will be 16 to 18 inches long and 2 pounds next year, and 3 pounds the year after. These are the trout our anglers catch. The fish we stock beef up on the big juicy zooplankton in Canyon Ferry. The growth rates here are just phenomenal."

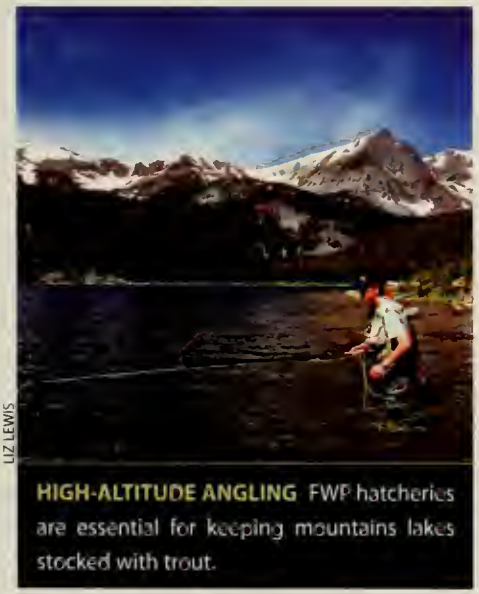
Dalbey explains that because Canyon Ferry and the other Missouri River reservoirs near Helena are manmade impoundments, they have litrle of the natural habitat trout need to spawn. Only 10 percent of the rainbow trout in Canyon Ferry are wild fish.

"This lake averages more than 100,000 angler-days of use each year," Dalbey says. "With that kind of pressure, the trout populations have to be augmented somehow. My goal is to maximize the opportunity for people to be out here fishing and catching trout, and these hatchery trout help me do exactly that. I've received letters from guys who have been

coming here for 20 years catching limits of big rainbows, and they tell me that they come because the access is good, the catch rates are great, and they love eating those fish."

Fish hatcheries in Montana have always been a work in progress, evolving to meet the changing needs of anglers and fisheries managers. In a state famous for its wild river trout fisheries, sustained by some of the best coldwater habitat in the world, it can be easy to overlook the role that hatcheries play. However, there is no denying that without hatcheries, Montana would lack many valuable coldwater and warmwater fisheries as well as an essential tool for helping conserve threatened and endangered fish species.

NEWS UPDATE: *Big Springs Hatchery manager Jack Boyce recently announced that his hatchery is back in action. In 2003 traces of PCBs were found in decades-old paint lining raceways of the fish-rearing facility, located in Lewistown. FWP was forced to destroy a half-million trout the following year and temporarily close the hatchery. The department's rainbow trout production dropped by 35 percent over the next two years and had to be supplemented with fish from the federal hatchery in Ennis. Working with the Environmental Protection Agency, FWP hired an environmental restoration firm to remove all the paint and line the raceways with a nontoxic sealant. Boyce recently said he and his crew are in full production and aim to raise a record number of trout in 2006.*



LIZ LEWIS

HIGH-ALTITUDE ANGLING FWP hatcheries are essential for keeping mountains lakes stocked with trout.

SEARCH AND DESTROY MISSION FWP fish health coordinator Jim Peterson tests samples of fish scheduled for stocking: "We guard against disease and pathogens getting into Montana waters."

Disease-free hatcheries help keep public waters disease-free

Like the famous pathophobe Howard Hughes, who wore Kleenex boxes over his socks when in hotels to keep from coming into contact with germ-riddled carpets, Montana FWP hatchery staff can be downright obsessive when it comes to keeping their fish healthy and their facilities sterile. They have to be. If stocked fish carry disease, they can infect public waters and threaten Montana's blue-ribbon trout rivers and popular reservoir fisheries.

"Once a disease or pathogen gets into the state, it's difficult or even impossible to eradicate," says Jim Peterson, FWP's fish health coordinator. "That's why we focus on preventing diseases and pathogens from getting into Montana in the first place."

Before fish from a state hatchery can be stocked, sample fish are tested and must be certified as disease-free. Wild fish used as brood stock to produce eggs must be tested before eggs can be collected. Testing is also done at least once each year on water, tanks, and raceways of all state, federal, and private hatcheries in Montana.

If any diseases or pathogens are detected, the facility is immediately quarantined and the infected fish are destroyed. The hatchery must then be completely disinfected, a process that can take up to a year, then inspected and certified as disease-free before fish can again be stocked from the facility.

"Most states have some disease regulations, but I think Montana is either as strict or stricter than any other state," Peterson says.

That includes careful screening of all requests from private pond owners to stock fish from out-of-state sources. "We're extremely careful about making sure trout imported into Montana come from a source free of diseases, fish pathogens, and aquatic nuisance species," he says.

Peterson points to whirling disease, which was first discovered in Montana in 1994, as an example of what he's trying to prevent. "Now that whirling disease is here, we'll never get rid of it," he says.

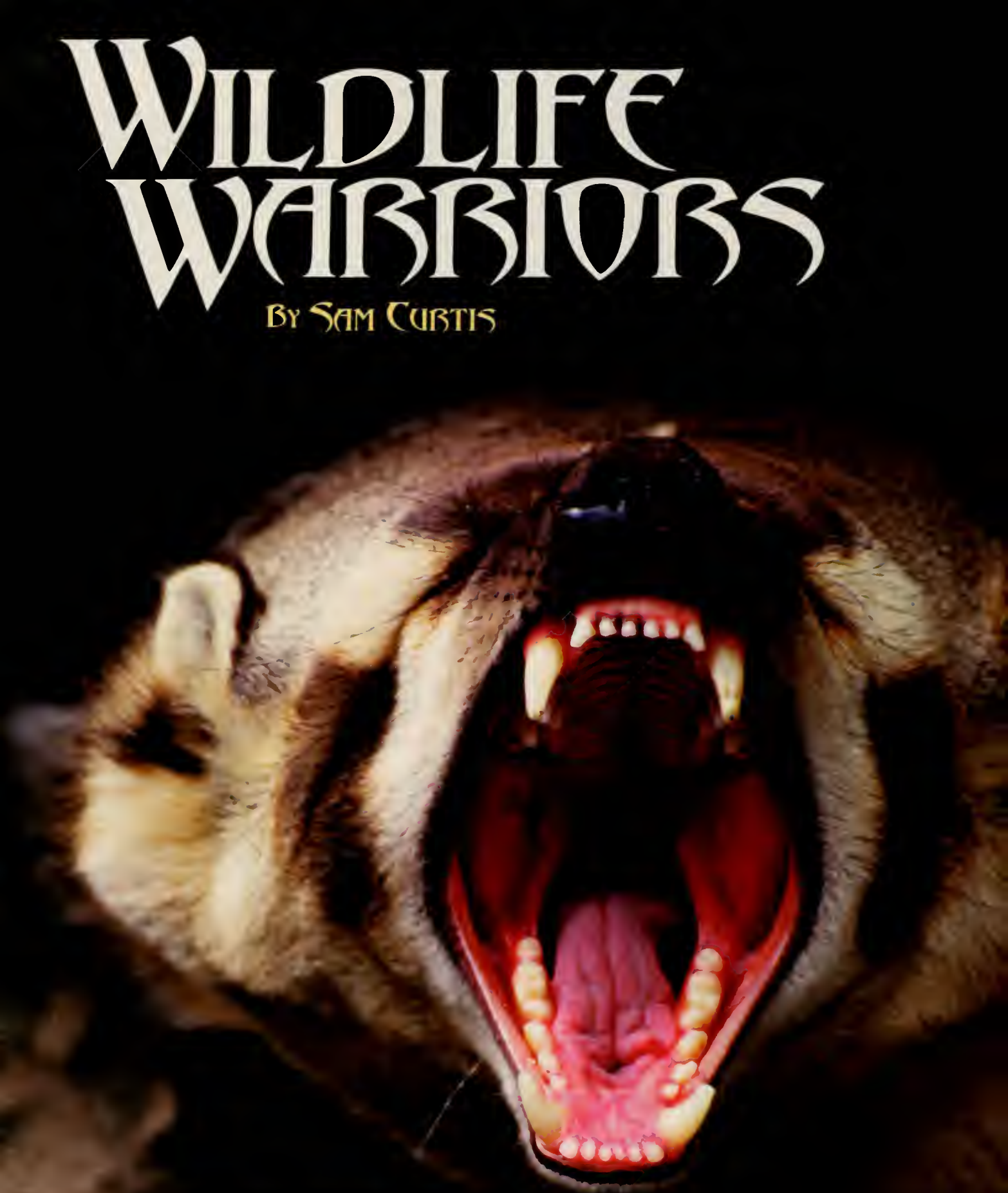
Because whirling and other diseases can be spread through infected water, FWP insists on using clean, disease-free water sources for its hatcheries. "In almost all of our hatcheries, the water comes from a fish-free underground source," Peterson says. "And in most cases, the water never reaches the surface before we pipe it into the hatcheries."

Inside the facilities, hatchery staff take pains to avoid contaminating water and equipment. "Every one of our hatchery managers and fish culturists is trained to detect and prevent fish diseases," says Peterson. "Equipment such nets, boots, and gloves is disinfected before being moved from one part of a hatchery to another. And when our crews visit a lake to stock fish, they won't even touch the water or allow their equipment to touch the water."

With the exception of whirling disease, Montana's fisheries have remained relatively disease-free. "We've been extremely successful keeping our waters clean," says Peterson. "But you never hear about that. The only time you ever hear about fish diseases is when something bad happens. So our job is to keep hatcheries from ever showing up on the front page."

Wildlife Warriors

By Sam Curtis



FANGS A LOT A badger bares its teeth in a defensive display meant to ward off an attacker. Many predators are even more ferocious when threatened than when hunting.

"Peaceable kingdom"? Not in the real, often violent world of nature

GEORGE ROBERTS

RACK ATTACK Though bucks will also use hooves and teeth during mating season battles, they primarily lock antlers and attempt to throw each other off balance in a battle of physical strength.

Some of my most vivid memories of wild creatures come from having seen their most aggressive behaviors. Two red squirrels, locked together tooth and claw, tumbling through dried leaves in a fight over territory. The flash of hummingbirds dueling over who gets the nectar from the first flowers of spring. Rival bull elk twisting and smashing their antlers into each other in a contest over mates. The bellow and stomp of a cow moose defending her calf (and sending me scrambling up a tree one afternoon).

There is no lack of warriors among the ranks of wild animals. There is also no lack of purpose behind their aggressive natures, whether they're on the offensive or the defensive. I'm not talking about the kind of aggression shown by a predator toward its prey. As Konrad Lorenz points out in *On Aggression*, "the fight between predator and prey is not a fight in the real sense of the word: the stroke of the paw with which a lion kills his prey may resemble the movements that he makes when he strikes his rival…but the inner motives of the hunter are basically different from those of the fighter. The opposite process, the 'counter offensive' of the prey against the predator, is more nearly related to genuine aggression."

ERWIN AND PEGGY BAUER

DIANE HARGREAVES

MICHAEL HANNUS

LIZ LEWIS

BACK OFF, JACK! Wildlife aggression comes in all manner and shape. Sometimes animals fight over food, such as the wolf attacking an intruder attempting to steal part of an elk calf kill. Bull elk will avoid an energy-draining fight if possible by showing off their antlers in an attempt to psych each other out. A rattlesnake is equipped with deadly fangs used both for hunting and to protect itself from harm. Male sage grouse, peaceable for most of the year, turn into warriors during early spring. They beat each other with wings, chest, and feet, trying to drive away rivals and establish the largest mating area.

Prey becomes aggressive toward a predator usually to preserve its life—like a woodchuck biting ferociously when cornered by a coyote. Males and females of most species will fight viciously in self-defense. And females, such as the cow moose that chased me up a tree, can be even more aggressive than males when defending their young.

WHY FIGHT?

Though some fights occur between two different species, most battles are fought between members of the same species. Though the wildlife warriors in these battles usually are not trying to kill each other, the fighting can result in death.

Why would members of the same species fight with such ferocity? Food is one reason. Animals that store and horde food for survival will aggressively protect their pantries. A squirrel jealously guards its middens of nuts and seeds, attacking any squirrels that try to steal from its stores. And a mountain lion resting near a fresh deer kill will fearlessly attack another lion that approaches.

Animals are also willing to fight to protect their food indirectly. For example, predators will defend a territory that provides them with enough prey, or food, to survive. This territorial aggression serves to space out members of a species across their range in a way that maintains sufficient food within each territory. But it also may limit population size. For example, if a pack of wolves cannot find, defend, or take over a suitable territory, the members may starve to death.

Aggression has a social function, too. By fighting, members of a pack, flock, or herd learn their place in the group's social order. This is called the "pecking order," named after chickens, which aggressively use their beaks on each other. In the strictly enforced poultry social hierarchy, a few birds never get pecked, a few always get pecked, and those in between know who they can and can't peck. This knowledge leads to a fairly harmonious flock, with minimal pecking, until a chicken decides to contest its ranking. That's when the feathers fly.

Sam Curtis, a freelance writer in Bozeman, is a frequent contributor to Montana Outdoors.

Researchers have learned that fighting can also determine overall group size. For example, when bobwhite quail bunch together during cold weather, they need a certain number of birds in the covey to stay warm. So, "quail coveys keep down their own size by aggressive behavior within the usual limits of 10 to 30 birds, which appears to be the number that can roost comfortably in the characteristic circle with heads facing out," writes Nicholas E. Collais in *Animal Aggression: Selected Reading*.

Nothing seems to inspire aggression more than the prospect of sex. Male bighorn sheep bash their heads together; wolves lunge at each other's throat; bison bulls gore their rivals' flanks—all for the opportunity to mate with a fertile female. The more evenly matched the amorous rivals are in size and fighting ability, the more aggressive and determined the battle. Bighorn rams, for example, have been known to fight for more than 24 hours over a ewe in estrus.

Though food, territory, social status, and mates may be won and kept by fighting, aggression takes its toll. Animal combatants face exhaustion, injuries, time away from resting and eating, and the ultimate cost of battle: death. Thus, it's in an animal's interest to win a war before it ever begins or to avoid a confrontation altogether.

WAR GAMES

"Many fights involve threat displays that emphasize or advertise an animal's size or weaponry and therefore intimidate other animals into giving up before the fight escalates," writes Dr. Felicity A. Huntingford in *Animal Behavior*, edited by Tim Halliday. A wolf raises its hackles to appear bigger to an opponent. A mule deer buck circles a rival, trying to display himself from an angle that makes his profile appear largest. A bull elk flaunts its antlers by offering a side view to opponents and by raising and lowering its head so the sweeping arc of the rack makes him appear larger than he actually is.

The purpose of all this posturing—the equivalent of guys wearing muscle shirts—is to allow a visibly inferior opponent the chance to walk away from a fight before it ever begins.

"A male of the territorial species has a better chance to produce offspring by moving to unoccupied territory than by wasting time and energy in hopeless battles with a superior rival," writes Niko Tinbergen in *Animal Behavior*. "Success goes to the animal that knows when to flee as well as when to attack. Thus it is a finely balanced system of attack and fleeing behavior rather than uninhibited aggressiveness that has value."

This balancing act between fight and flight, or between anger and fear, is called "agonism." It leads to some intriguing responses in animals that experience both urges at the same time. When the flight response is stronger, there is usually little indecision. For example, a forkhorn whitetail confronted by a large-beamed four-point buck either runs off or shows submission by averting his head from the superior rival and looking away while pressing his tail between his legs.

But when the fight and flight urges are equally intense, an animal may display what's known as "conflict behavior." For instance, certain fish, when faced with an aggressive rival, wildly swish their tails to propel themselves forward at the same time they are wildly back-paddling with their pectoral fins to move themselves in reverse. The end result of this conflict behavior is that the fish don't move at all.

Anger and fear felt simultaneously may also give rise to what is termed a "redirected response." Sometimes, writes Tinbergen, "a provoked animal will attack, but instead of attacking the source of its anger, perhaps a large and fearsome-looking opponent, it will attack a smaller or weaker bystander or even a stick or leaf on the ground—as you or I might, in frustrated anger, bang the table with a fist. Under extreme provocation, an animal may even make movements that have no direct relationship to threats and fighting at all. Male starlings will deal with the tense situation of facing each other near a nest hole by preening their plumage assiduously between bouts of actual fighting."

WEAPONS AND ARMOR

Actual fighting, of course, requires the use of weapons and defenses. Birds use their beaks and talons to peck, bite, and puncture opponents. Deer and elk fight with antlers, hooves, and teeth. Horned and tusked creatures employ their weapons as battering rams and swords. Insects have

WILDLIFE WEAPONS

ERWIN AND PEGGY BAUER

TALONS

For killing and gripping prey, also used in fights.

BARBARA THOMAS

QUILLS

Defensive weapons, not launchable.

DANIEL J. COX

ODOR

An effective chemical deterrent.

DONALDMONES.COM

SPURS

Ankle daggers wielded by wild turkey gobblers.

PHIL FARMER

CLASH OF THE TITANS The social hierarchy among bighorn sheep rams is based on horn size. The bigger and thicker the curl, the more dominant the ram. When two rams of equal horn size meet up during mating season, they engage in battle by charging head on at speeds that may exceed 20 miles per hour. Battles between two well-matched males can sometimes rage all day. Thick, double-layered skulls and powerful neck muscles cushion the brutal blows.

stingers, pincers, and nippers. Snakes attack with fangs and teeth.

In addition to these conventional tools of war, some animals deploy "chemical weapons." The foul-smelling liquid a skunk sprays from glands at the base of its tail can hit an intended target 10 feet away, blinding and choking the adversary.

Skunks aren't the only animals with a chemical arsenal. Some termites squirt a toxic gluelike substance that poisons their enemies and makes them stick to the ground and to each other. And the petrel, a long-winged seabird, will spit the slimy, rank contents of its stomach—the partially digested food it regurgitates to feed its chicks—into the face of aggressors.

In addition to possessing weapons, many animals and insects wear defensive body armor and shields. The cylindrical exoskeleton of an insect is made of *chitin*—a tough, light, flexible substance that resists chemicals and makes an ideal suit of armor. Turtles and armadillos also wear protective body gear, while hedgehogs and porcupines have quills that discourage aggressors. Porcupines have the added advantage of being able to use their protective covering offensively, whacking their quilled tail into an attacker's snout (something anyone who lives with dogs in the country knows only too well).

STRATEGIES OF WAR

When attacking others or defending themselves, animals employ special fighting tactics. When a cat or fox steals eggs or chicks from nests at night, the adult birds will "mob" the predator if they catch it out in the open during the day. Recently, I watched a dozen magpies swooping and diving on a coyote as it crossed a field near my home. The birds actually struck the predator with their feet on several passes, forcing it to duck and cower its way into a nearby hedgerow.

Male musk oxen use a "circle-the-wagons" tactic when attacked. They stand shoulder to shoulder in a circle with their heads and horns facing out while cows and calves crowd in the center. This defensive maneuver is often enough to discourage even the hungriest wolves from attacking.

When experiencing the simultaneous emotions of anger and fear, and the companion impulses to fight and to flee, some animals just bluff. A friend told me the story of an acquaintance who encountered a grizzly bear that used this tactic in the Taylor-Hilgard Mountains of southwestern Montana. The man didn't sense trouble until the huge bear was already charging out of the bushes toward him. The sow grizzly stopped abruptly several feet from the terrified hiker, who stood frozen with fear. The bear let out a deafening woof that blew foul breath into his face, then slowly turned and herded her cub into the brush.

The man was not carrying a weapon or bear pepper spray and was no match for the grizzly. Of course, the grizzly could not have known that. She had been startled into charging to protect herself and her offspring, but she also must have felt the urge to flee. The hair-raising bluff was the end result.

Call this process of conflicting urges the psychology of animal warfare. Animals will use bluffing, posturing, retreating, or any other tactic at their disposal before engaging in conflict that risks their life or that of their young. Wildlife are well equipped to do battle, but it appears that most will take whatever measures are necessary to keep the peace.

That's a good lesson for any animal to learn.

Walleye

Sander vitreus

By Tom Dickson

Trout are western Montana's main attraction, but I have a soft spot for walleyes. Partly, it's the challenge. Catching a walleye requires negotiating massive reservoirs, trying to puzzle out underwater bottom structure, and staying alert for hours to feel the gentle tug of a fish inhaling your nightcrawler. The main reason, however, are those thick, white, bone-free fillets. There's no better eatin' fish.

APPEARANCE A close relative of the yellow perch, the walleye is a torpedo-shaped, medium-sized fish with marblelike eyes, a spiky dorsal fin, and sharp teeth. Though not indigenous to Montana, the walleye closely resembles its native cousin, the sauger. The main physical difference is that walleyes have a white corner on the lower lobe of their tail, while sauger don't. And walleyes lack the several rows of distinct black spots on the dorsal fin that sauger have. Some old-timers still call walleyes "wall-eyed pike," but the fish are not related to pike.

Tom Dickson is editor of Montana Outdoors.

THE EYE The walleye name comes from its large, glassy pupils. The opaque quality of the eye comes from a reflective layer of pigment, called the *tapetrum lucidum*, in the inner eye. The pigment layer allows walleyes to see prey at night or in murky water. This accounts for the fish's tendency to bite mostly after dark and on cloudy days, and to stay deep when the sun shines. On bright days, boat anglers hope for enough wind to create a "walleye chop"—waves that break up light rays enough so that walleyes move up into shallower water.

LOCATION In Montana, walleyes are now found in dozens of reservoirs east of the Continental Divide. The biggest is Fort Peck, which contains a nationally known walleye fishery. FWP stocks walleyes there and at Fresno, Nelson, Bighorn, Cooney, and Frances reservoirs. Canyon Ferry, Holter, and Tiber reservoirs have self-sustaining walleye populations that don't require stocking. Both the lower Yellowstone River and most of the Missouri River contain walleyes.

SIZE Walleyes can grow large. The state record, from Fort Peck Lake, is 16.63 pounds. The world record, from Tennessee, is 25 pounds. Most walleyes caught in Montana are a respectable 1 to 2 pounds.

ERIC ENGBRETSON

PREY Walleyes are predators. They eat fish such as yellow perch, minnows, small trout, and also small walleyes. In Canyon Ferry alone, walleyes eat more than 750,000 pounds of perch each year—about 4 pounds of perch per walleye.

FISHING The best walleye fishing is usually in early summer. Perch and other prey spawn in the spring, and their abundant young are too small for adult walleyes to eat until midsummer. As a result, walleyes more eagerly attack bait and lures. Fishing picks up again in fall as walleyes beef up in preparation for winter and forage fish numbers, reduced by several months of predation, decline. The years of best fishing are those when lakes produce few forage fish, increasing the odds that walleyes will go after an angler's lure or bait.

MANAGEMENT Because many reservoirs have relatively little natural walleye spawning habitat, FWP rears and stocks about 40 million walleyes each year. Roughly 90 percent of these are mosquito-sized fry. Biologists take care to not overstock reservoirs, which can cause stunted growth. The new hatchery at Fort Peck Lake (see page 29) will boost FWP's ability to rear and stock walleyes.

"Managing walleyes in reservoirs is extremely difficult," says Dave Yerk, FWP fisheries biologist in Choteau. "Water levels are constantly in flux, and it's nearly impossible to keep the right balance between prey and predator species. We do our best, but we hope anglers understand that a lot of major factors affecting the size of walleye populations, such as drought, are simply beyond our control."

Some anglers have asked FWP to stock walleyes west of the Continental Divide. However, fisheries biologists are concerned the fish would escape stocked waters and damage westslope cutthroat trout and other native fisheries.

For more information on walleyes and walleye fishing, visit the Montana Walleyes Unlimited website at walleyesunlimited.com/.

WEIGHING ITS CHANCES

One of the relatively few remaining adult pallid sturgeons on the upper Missouri River is carefully measured by FWP fisheries biologists. Can this prehistoric species survive dams and the loss of historic spawning and rearing habitat? See page 20. Photo by Andrea McClenning

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